

Electrical Contracting

THE MAGAZINE OF ELECTRICAL
CONSTRUCTION & MAINTENANCE

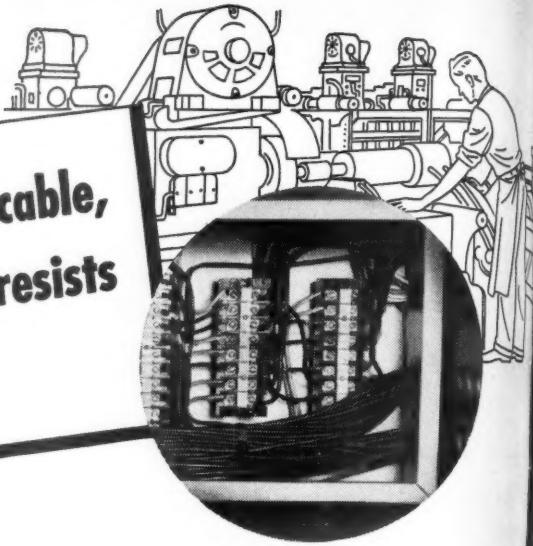
AUGUST • 1945



IN THIS ISSUE...

What's ahead for veterans in electrical construction . . . progressive relighting . . . the how and why of protective grounding . . . maintaining electronic temperature control systems . . . practical and useful methods for the shop and job.

PROBLEM: to find insulated cable, for wiring machine tools, which resists all kinds of cutting fluids



First solved with **FLAMENOL** cable

● Not long after the introduction of Flamenol*, in 1935, a prominent manufacturer of automobiles was searching for insulated cable which would withstand machine-tool cutting oils and coolants. When a G-E sales engineer showed the manufacturer a sample of Flamenol—and described its excellent resistance to oils, water, and heat—the company's chief electrician immediately ordered 6000 feet. The company found this cable so satisfactory that it now specifies Flamenol to be installed on all the machine tools it buys. If you have a problem of finding insulated cable or wire that will withstand severe conditions, such as contact with cutting fluid, Flamenol may very likely be the answer. It has proved its many desirable properties in hundreds of power and lighting applications.

RESISTS FLAME—Flamenol does not support combustion. Thus, it prevents serious outages due to fires that involve wiring. Requiring no protective braid, it reduces the volume of wiring and eliminates terminating problems due to fraying. Flamenol's insulation strips easily and leaves the conductor surface untarnished. It is highly resistant to oils, water, mild acids and alkalis, and weather. It is tough, stable, and flexible at low temperatures, and has high dielectric strength.

A G-E "FIRST"—Only G.E. makes Flamenol wire and cable. Flamenol is the pioneer of wire and cable, insulated with plasticized polyvinyl chloride. It was produced by G.E. in 1935—not as a substitute for rubber-insulated wire, but as a new type possessing desirable properties

not available with rubber. To find out how Flamenol can help solve your problems—save you time, trouble, and expense—ask our local office, or write General Electric Company, Schenectady 5, N. Y.

*Trade-mark reg. U.S. Pat. Off.



GENERAL ELECTRIC

502-52-1200

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ELECTRICAL
GUARANTEED
Electrical Con-
for three years.
Master August

Murray Crows'nest

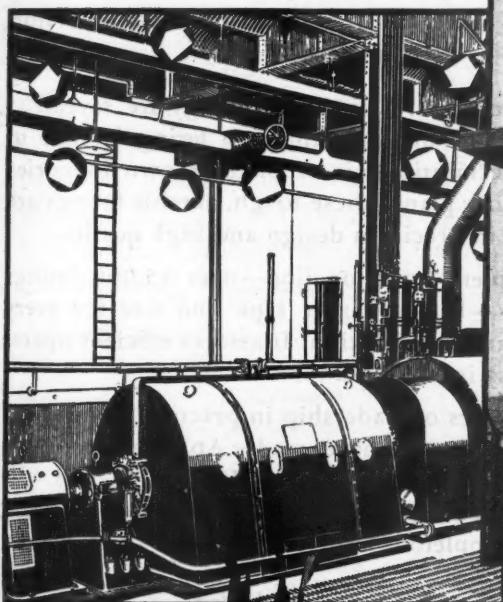
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HARD-TO-REACH
UP-IN-THE-AIR

MAINTENANCE

Real aerial ladder rigidity. Custom built with every bit of needed flexibility, the Crows'nest is the fastest, safest one-man-operated maintenance ladder we know.

No gadgets to get out of order or forget. Simple design, compact. Needs only occasional lubrication.

State your requirements. Let us send the facts—
no obligation. Metropolitan Device Corporation,
1250 Atlantic Ave., Brooklyn 16, N. Y.



Above:
Reaching street light
from awkward position
due to parked car.

Top left:
Line clearance of trees
or other obstructions
are typical Crows'nest
jobs.

Center:
Another instance of a
hard-to-get-at serv-
ing job.

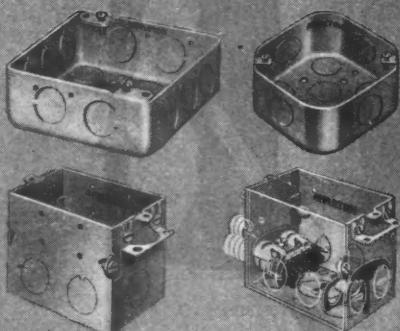
Left Center:
Trailer mounted
Crows'nest adapted
for indoor overhead
maintenance in power
stations. See arrows.



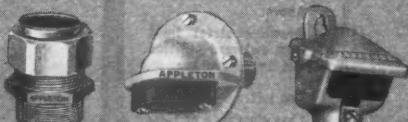
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*"It's Good, Sound
Procedure to Specify
APPLETON
FITTINGS"*

OUTLETS...SWITCH BOXES
CONDUIT FITTINGS FOR
EVERY SPECIFICATION



3½ and 4-inch Octagonal Boxes; 4 and 4½ inch Square Boxes; Switch Boxes in various depths, with or without clamps and brackets.



Fittings and Connectors for various types of Entrance Cable.



Couplings and Connectors, Entrance Fittings
for Electrical Metallic Tubing.



Couplings and Connectors for Rigid Conduit.



Straight and Angle Connectors for Armored Cable, Flexible
Conduit, etc.

- **COMPLETE LINE** for smooth, easy installation
- **PRECISION DESIGNED** for efficient operation
- **RUGGEDLY BUILT** for permanence
- **PROMPT SERVICE** for quick plant-reconversion

Jobs run smoother . . . time and energy are saved . . . safety is stepped up with Appleton fittings! Made to exacting specifications in Appleton's own foundries and fabricating plants, these tough, durable fittings are outstanding in precision design and high quality.

The complete Appleton line—over 15,000 fittings and fixtures—has an exact type and size for every preference and specification! It assures efficient operation and easy installation.

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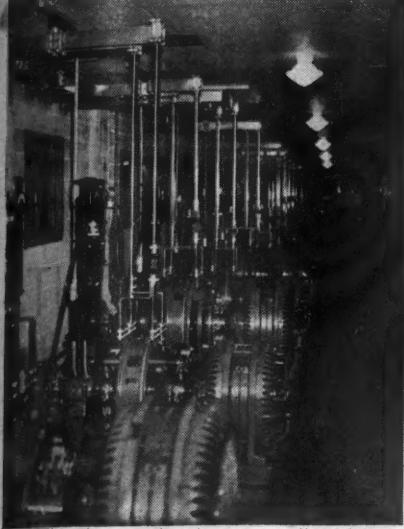
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APPLETON

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES



Electrical Contracting

Contents for August, 1945

Air cooled generator room in the plating department at Chrysler Corporation's Dodge-Chicago plant where B-29 engines roll off the lines. Positive air pressure prevents dust and dirt of manufacturing area from entering room thus reducing machine maintenance to a minimum.

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A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor sales, covering engineering, installation, repairing, maintenance and management in the field of electrical construction and maintenance.

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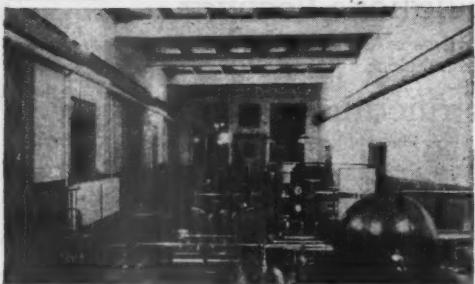
You can solve many difficult lighting problems with

CROUSE-HINDS

high-efficiency FLOODLIGHTS



Type ADE
Heavy Duty Floodlight



Above: Installation showing the use of Crouse-Hinds Type ADE heavy duty floodlight for general illumination, together with Type VAW obstruction lights for air markers.

Left: Installation showing the use of Crouse-Hinds Type ADE heavy duty floodlights outdoors, for lighting an interior in an extremely hazardous location where no electric wiring was used within the building.

Right: Installation of Crouse-Hinds Type ADE heavy duty floodlights on a steel tower for general illumination.

Medium or long range.

Weatherproof and dust-tight cast aluminum alloy housings.

*Alzak reflectors with mirror finish — your choice of narrow or wide beam.

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Crouse-Hinds also have a complete line of Light Duty Floodlights that provide adequate light at minimum first cost, and Explosion-Proof Floodlights for use in hazardous interiors.

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Holding an acetylene torch in his right hand, a silver alloy rod in his left, Sam silver-brazes end connections of Allis-Chalmers' "Indestructible Rotor."

Round and round the connections he works — expertly flowing in molten alloy to form a joined structure that can withstand as much heat as though it were a single die-casting.

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And that's the test in which Allis-Chalmers motors have proved over the years that they're *great* motors. That's why you hear it said so often: "*You can depend on Allis-Chalmers Motors!*"

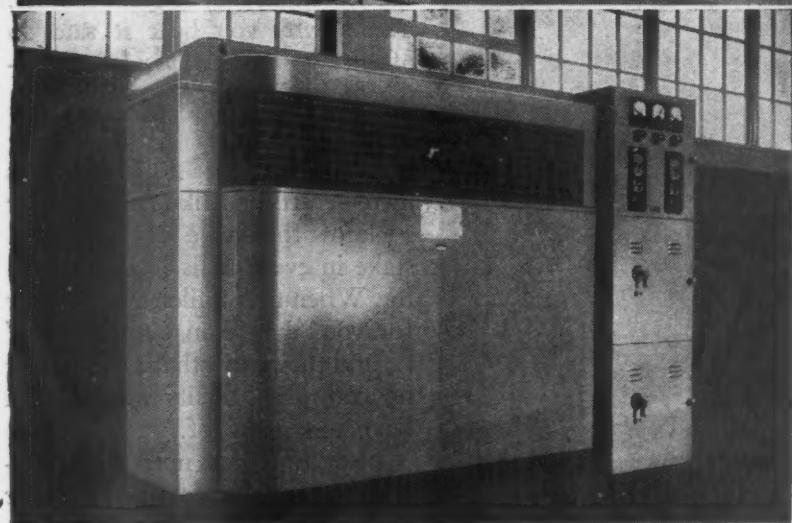
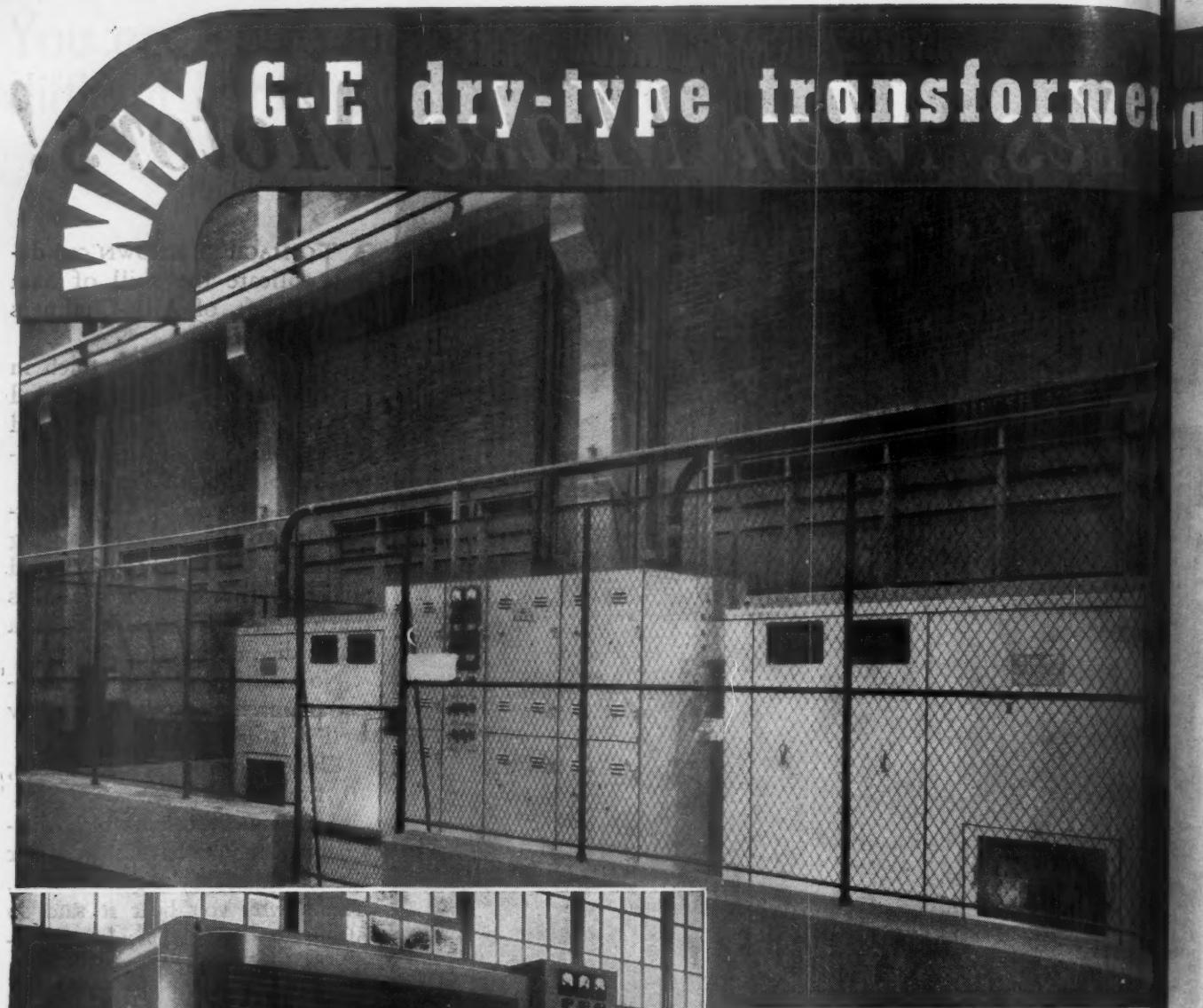
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YES, HUNDREDS of Allis-Chalmers men—craftsmen like Sam Meister — know they have a big personal stake in every Allis-Chalmers motor. When they build a great motor for you, they're making a *friend* ... and they know that's something no company and its workers can have too many of.

Next time *you* need great motors contact our district office. Or write direct to **ALLIS-CHALMERS**, MILWAUKEE 1, WISCONSIN.

A 1730



YOU CAN **DEPEND ON ALLIS-CHALMERS MOTORS**



At a light-metals plant in Pittsburgh—This 2000-kva, 4160-to 480-volt unit substation is one of five such installations at this plant. (The enclosing fence is to prevent tampering with controls.) Compare the metal-enclosed construction of this dry-type equipment with conventional open-screen designs.

Good looks is a standard feature of all G-E dry-type load-center unit substations. Such units are "natural" for distribution revamping programs because, if you so desire, you can buy them one block at a time and still end up with a completely modern co-ordinated system—a system in which the self protection of each substation confines most troubles to a small area and prevents crippling plant outages. Available in ratings from 200 to 2000 kva, 601 to 15,000 volts.



IN USE FROM COAST TO COAST

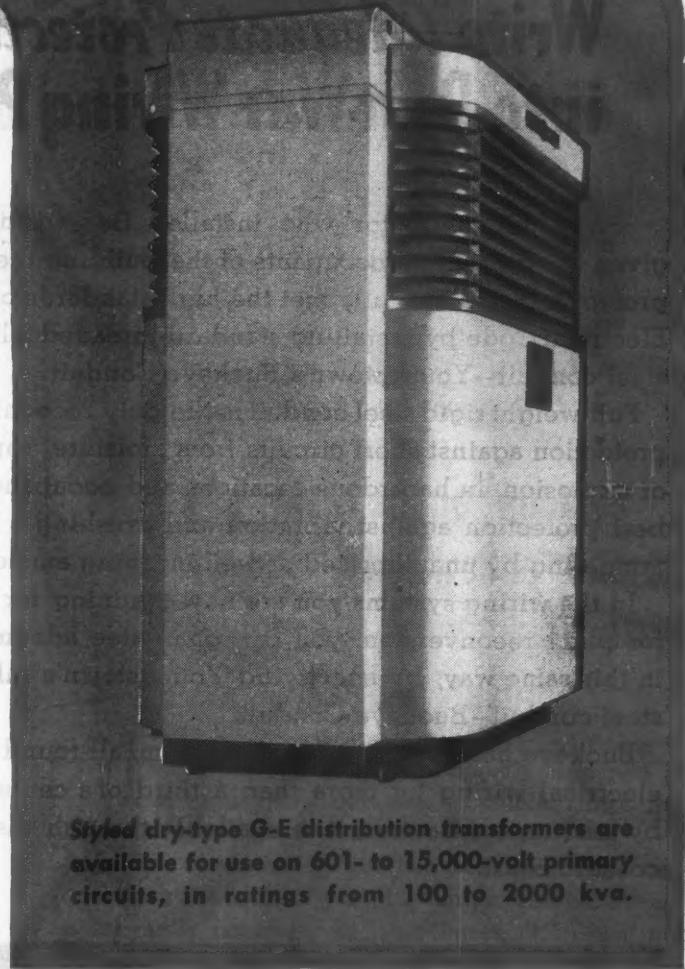
new have won wide acceptance

1. These ultramodern, dry-type distribution transformers are designed to meet AIEE Standards No. 1 for Class B insulation, with 130°C maximum hot-spot temperature in a maximum ambient of 40°C. They also meet ASA Standards C-57.1, which limit the observable temperature rise to 80°C.
2. Because they meet industry standards for hot-spot temperature, G-E dry-type transformers are better suited to handle emergency overloads than units designed to higher temperatures. Longer life under severe service conditions is the inevitable result.
3. Housings are designed for utility, and are attractive in appearance.
4. Completely metal-enclosed construction prevents rods and wires from being accidentally pushed into the live parts.
5. There are no exposed live parts, such as bushings, that would lessen safety and make a fence mandatory.
6. Cable terminal compartments are completely removable, so the high-voltage and low-voltage cables can be made up and the unit slid into place between them without the use of a crane or elaborate hoisting and jacking facilities.
7. Transformer side plates are readily removable to facilitate inspection and cleaning of the core and coils.

If you prefer dry-type designs, you will find these ultramodern dry-type transformers ideal for modernizing your plant's power system.

Their trim good looks, their safety, and ease of installation make dry-type units "at home" anywhere in your plant.

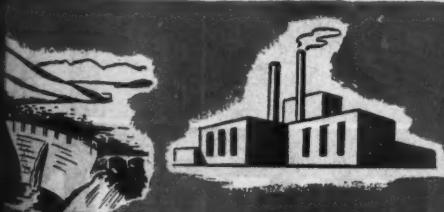
They fit right in with the economic good sense of **load-center power distribution**, which offers savings in installation cost, power, and assurance of full voltage at every lamp and machine.



Styled dry-type G-E distribution transformers are available for use on 601- to 15,000-volt primary circuits, in ratings from 100 to 2000 kva.

When these transformers are a part of unit substations, the interrupting capacity of the substation switchgear section is exactly matched (electrically, mechanically, thermally) with the transformer capacity. It is adequate for even the most severe short circuits.

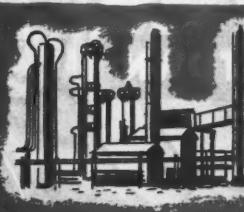
Ask for Bulletin GEA-3592A (load-center unit substations); Bulletin GEA-3714B (dry-type distribution transformers). **General Electric Company, Schenectady 5, N. Y.**



INDUSTRIAL PROJECTS



POWER COMPANIES



ON REFINERIES



SHIPIARDS

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Write "Adequate Protection" into Post-War Wiring Plans

THE contractor who installed this wiring system has given the owner and occupants of the building the maximum in protection. He has fully met the high standards of the National Electrical Code by installing standard-threaded full-weight rigid steel conduit--Youngstown's Buckeye Conduit.

Full-weight rigid steel conduit is the only recognized adequate protection against short circuits from moisture, vapor, dust, dirt, or explosion, in hazardous locations and occupancies. It is the best protection against vibration and crushing. It discourages tampering by unauthorized or well-meaning amateurs.

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Buckeye has been furnishing uniform, all-round protection for electrical wiring for more than a third of a century. Preferred by leading contractors, it is available through distributors from coast to coast.



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YOUNGSTOWN
CONDUIT

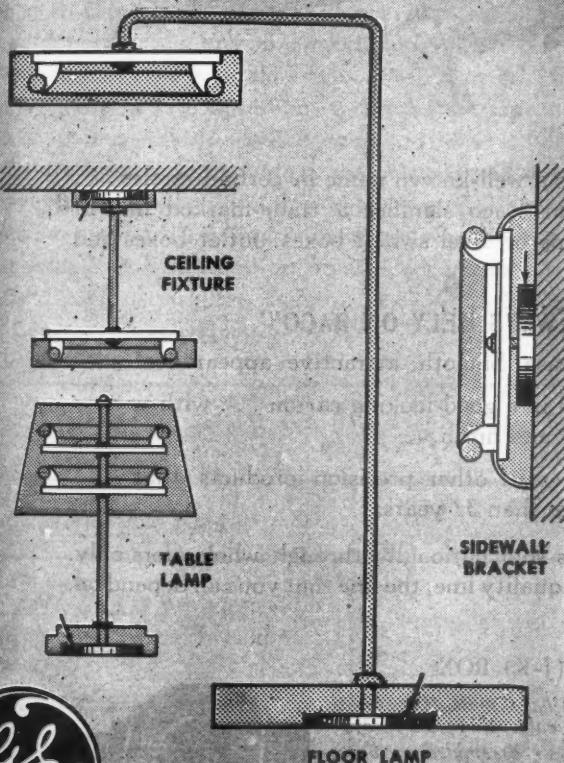
Ask your distributor for:
Youngstown Buckeye Conduit-Pipe and
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THE NEW 12-INCH CIRCLINE LAMP
[8 1/2- and 16-inch (diameter) sizes
will soon be available]

A few suggested applications of ballast and lamp



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LAMPS
STARTERS
LAMPHOLDERS
CABLE
for DEPENDABILITY in fluorescent lighting



The disk shape enables
you to use the Circline fluores-
cent lamp to fullest advantage
in your new designs

THIS new ballast is functionally designed for easy use in your new portable lamps and decorative lighting fixtures.

The center hole of the ballast facilitates mounting on the stem of portable lamps. The ballast can be easily concealed in lamp bases, or in wall and ceiling fixtures. Connection to the fluorescent lamps is made by threading the ballast leads through the lamp stem.

This ballast is available in uncorrected- or high-power-factor, single-lamp ratings for use on 110- to 125-volt circuits. The uncorrected-power-factor design is 6 inches in diameter and 1 3/8 inches in height. The high-power-factor unit, of the same height, is 7 inches in diameter.

Write today for a copy of Supplement No. 3 to Publication GEA-3293F. It is a "must" for your file of postwar lighting ideas. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

Buy all the BONDS you can
—and keep all you buy

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RACO

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who Raco is?"**

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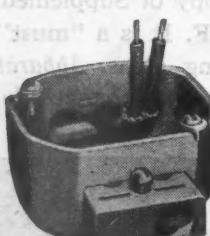
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Every Raco product comes neatly packed in a good-looking carton . . . with a readable index showing number, quantity and finish.

The same exacting standards are used as in other precision products that All-Steel has been manufacturing for more than 32 years.

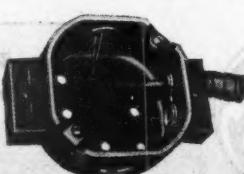
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SWITCH BOXES • OUTLET BOXES

Now UP TO 2000 hp!

STANDARD 2000-HP

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THEY GIVE EXTRA PROTECTION

3 ways

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The Tri-Clad motor, in its wide range of types and sizes, is industry's most popular integral-hp motor. Chances are there's a standard Tri-Clad to meet your requirements "on the nose." For information on G.E.'s complete line of Tri-Clad motors, ask for Bulletin GEA-3580. General Electric Company, Schenectady 5, N. Y.

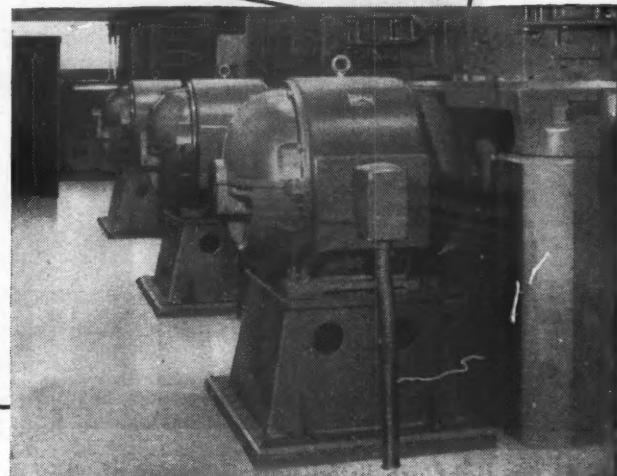
HERE'S TODAY'S WIDER RANGE OF STANDARD SIZES

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Three of the new, large Tri-Clad motors, each rated 200 hp, 1200 rpm, driving coal pulverizers in a Southern steam-electric plant.

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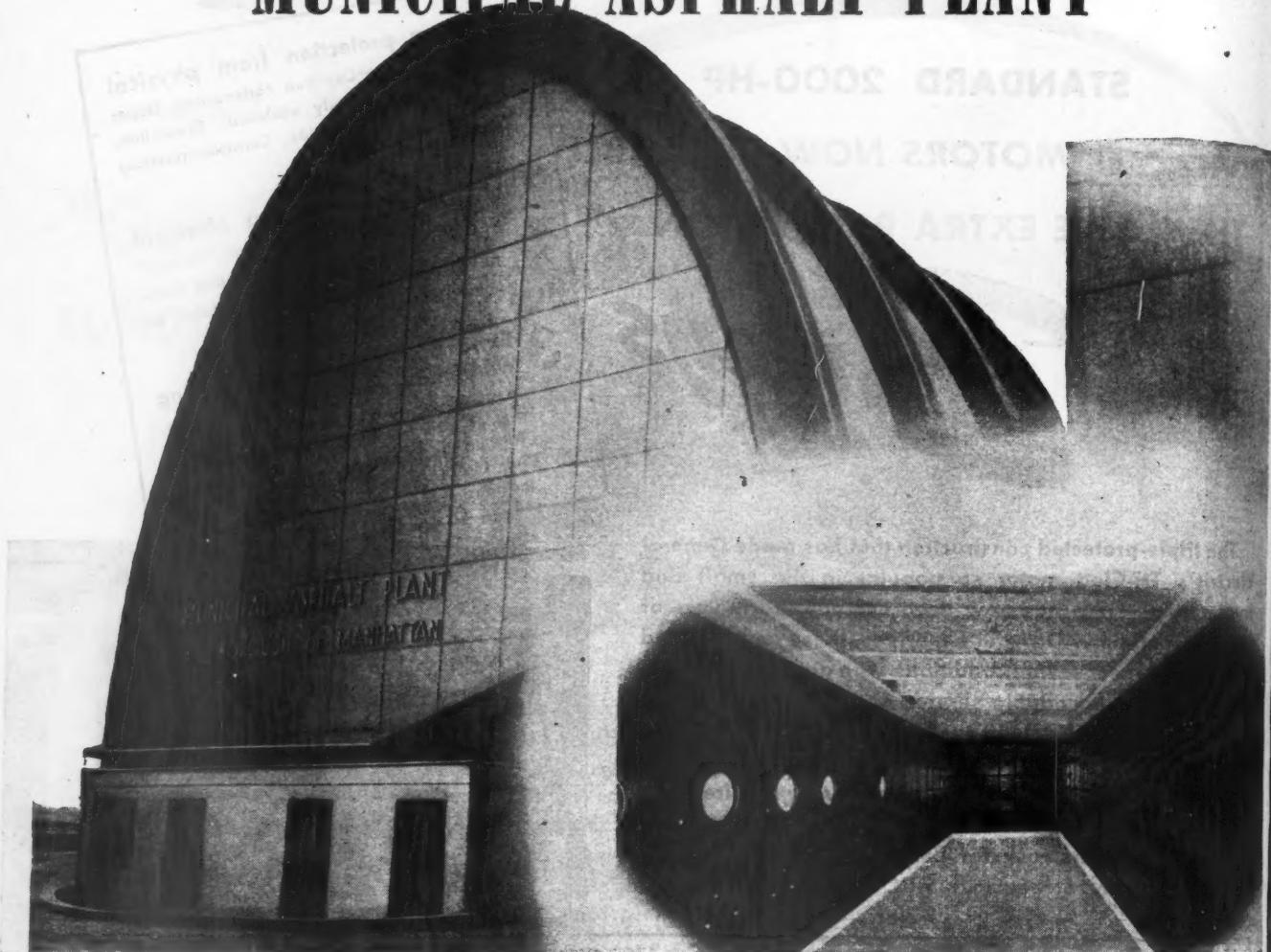
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METROPOLITAN'S ELECTRICAL UNIT FOR HEATING, MOTOR AND LIGHT CONTROL IN THE MUNICIPAL ASPHALT PLANT



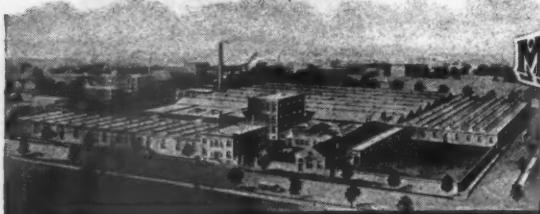
At the right are listed various types of electrical control equipment designed and furnished by METROPOLITAN for utilities, industrial plants, large mercantile establishments, and public buildings. Your inquiries are invited.

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Circuit Breaker Switchboards
Dead Front Switchboards
Battery Charging Switchboards

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Explosion-proof Switchboards
Laboratory and Test Switchboards
Control Switchboards
Generator and Distribution Switchboards

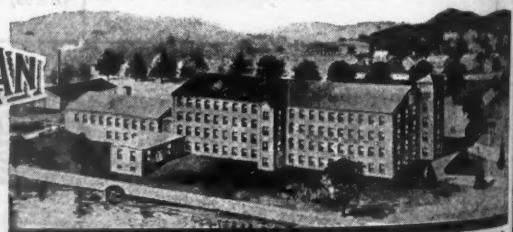
*Complete
Electrical Control by*

METROPOLITAN ELECTRIC MANUFACTURING CO.



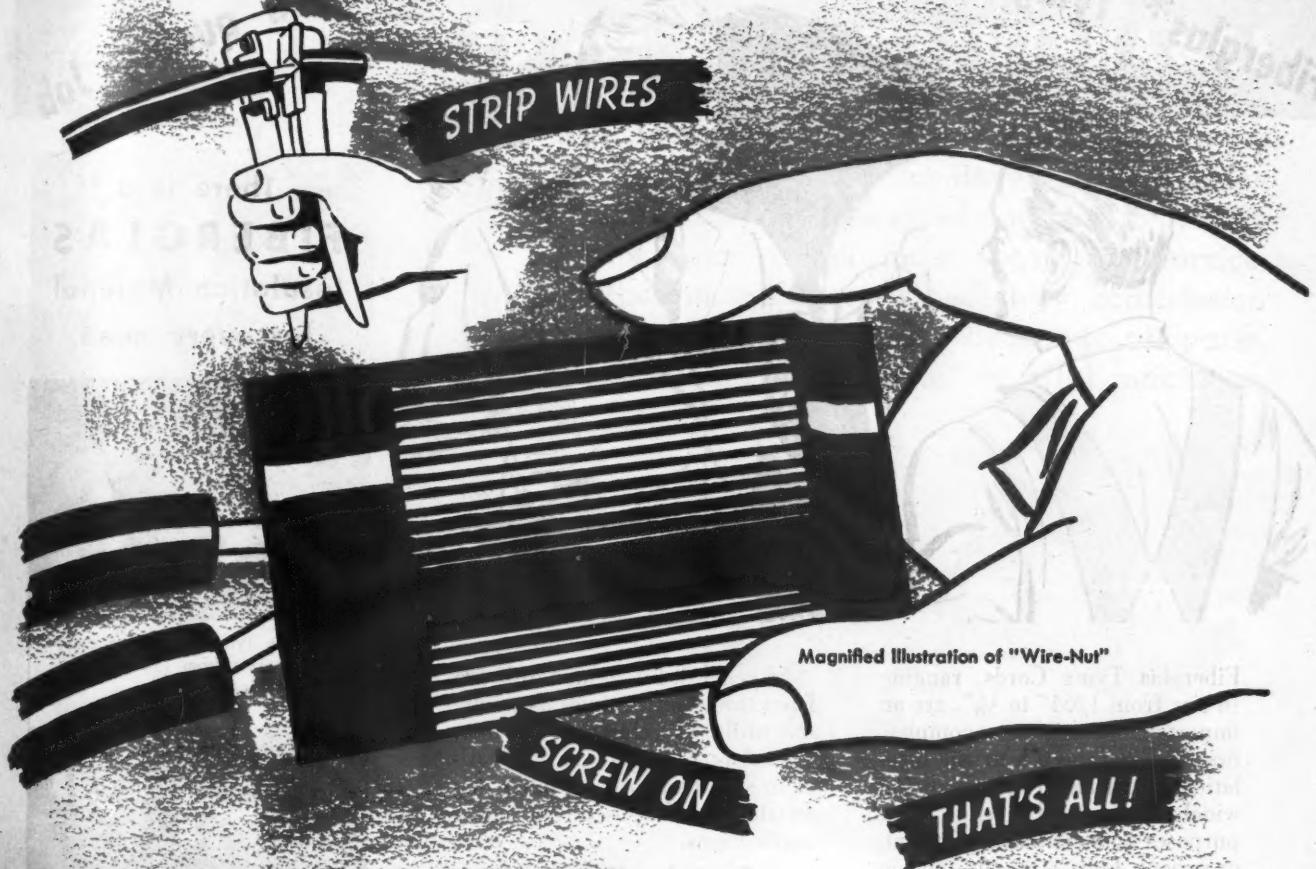
ESTABLISHED 1882
METROPOLITAN
TRADE MARK

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AND POWER DISTRIBUTION EQUIPMENT



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Sales offices in all principal cities

IDEAL Sycamore

Fiberglas* Tying Cord puts the finishing touch on a quality job



Fiberglas Tying Cords, ranging in size from $1/64"$ to $1/8"$, are an important part of the complete line of Fiberglas Electrical Insulation Materials. They are being widely used for all types of tying purposes on electrical equipment, or where high strength tension member is required.

Universally adaptable Fiberglas Cords provide all of the advantages inherent in Fiberglas, such as: heat, moisture, acid resistance, and exceptionally high tensile strength-to-size ratio. For example, the minimum breaking strength of $1/32$ " Fiberglas Cord, number EC5-1, is 66 lbs., that of $1/8$ " cord, number EC5-8-T, is 274 lbs.

Does many Jobs . . . Better

Fiberglas Tying Cords are widely used for banding field coils; for wrapping string bands on small armatures; for protecting front of the commutator V-ring from flashovers on motors; as banding, on the V-ring extensions on some d-c equipment; as filling, in winding certain coils; for reset strings; and for tying slot insulation in place. It is also used to lash ends of coils in large motors and generators, and to hold spacer blocks in place.

In general, Fiberglas Cords are from three to five times as strong as ordinary electrical twines. Therefore, Fiberglas Cords, smaller in size than cords of other materials, can be used for many applications.

Treated or Untreated

Treated cord is used primarily for its increased knot strength and abrasion resistance. For general applications in the construction or repair of electrical equipment, the treated cord is preferred. Where space is to be filled, regardless of strength requirements, the untreated cord is frequently used.

Complete Information

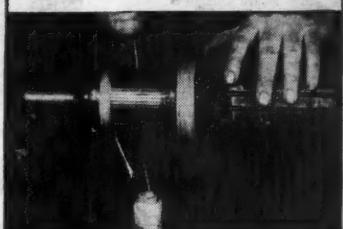
The new Fiberglas catalog EL44-7 gives performance and application data of interest to anyone concerned with electrical insulation—also facts about Fiberglas Tapes, Fiberglas-Insulated Wire and Cable, Fiberglas-Mica combinations and other Fiberglas-base Materials. Write for a copy today, and ask for the name of the supplier located nearest to you.

Owens-Corning Fiberglas Corporation, 1856 Nicholas Building, Toledo 1, Ohio.

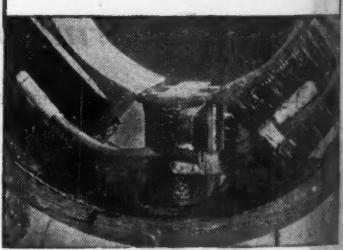
*In Canada, Fiberglas Canada Ltd.,
Oshawa, Ontario.*



Fiberglas Tying Cords are available in sizes from $1/64''$ to $1/8''$, in $1/64''$ increments.



Fiberglas Tying Cords are widely used for banding commutator leads, and over V-ring extensions.



Used most frequently because of its high strength-to-size ratio—as shown in this stator tying application.



Write for catalog El 44-7, today.

Each distributor of Fiberglas-base insulation Materials has his own source of supply, since Owens-Corning Fiberglas Corp. does not process these materials.

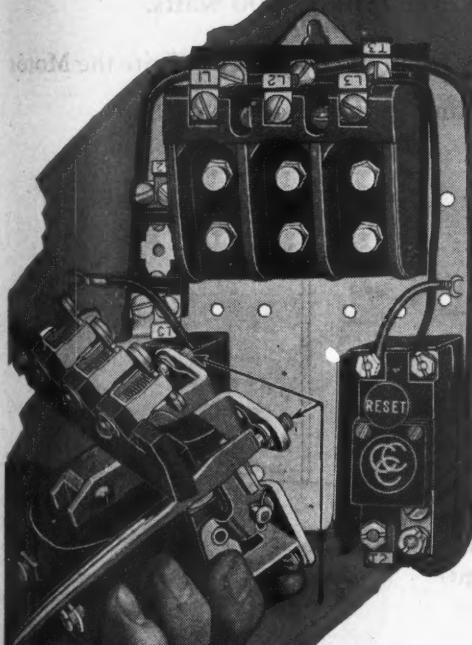
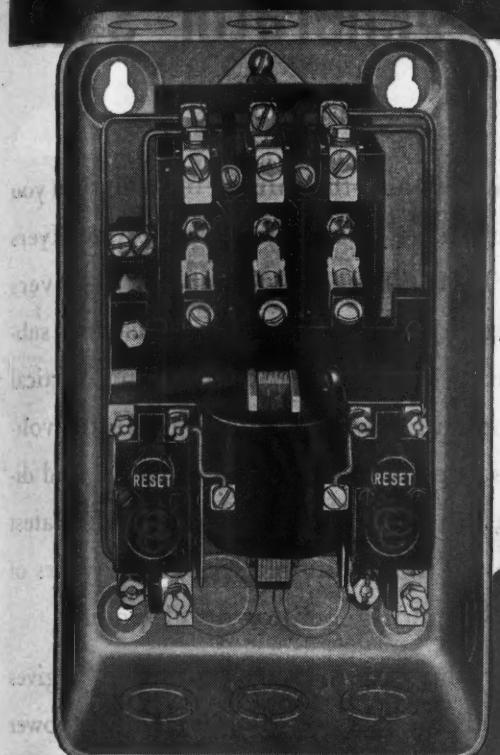
FIBERGLAS

*T. M. Reg. U. S. Pat. Off.

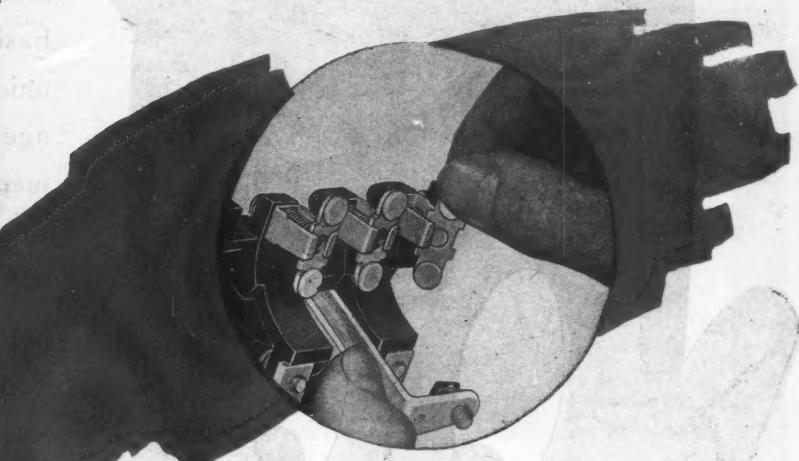


ELECTRICAL INSULATION MATERIALS

"3C" Bulletin 6013 AC MAGNETIC STARTERS are ENGINEERED for EASY MAINTENANCE



Clark Bulletin 6013 Non-Reversing Across-the-Line Starters are designed and built to provide safe motor control under heavy duty service. When maintenance is necessary, construction permits quick and easy access to all parts, minimizing "down-time" of vital machines.



Changing Contact. A twist of the fingers removes worn moving contacts and replaces new ones. The contacts are so designed that they can easily be slipped into position. Alignment is automatic. The contact pressure springs are anchored in position and will not fly out of place when the contacts are removed.

Moving Mechanism. Illustration at left shows entire moving mechanism separated from the mounting plate for major maintenance purposes. Loosening two screws which are retained in position by special spring clips does it. All moving parts are thus exposed for easy handling.

Ask for Fully Descriptive Bulletin 6013.

Our Distributors and District Offices will welcome your inquiries.

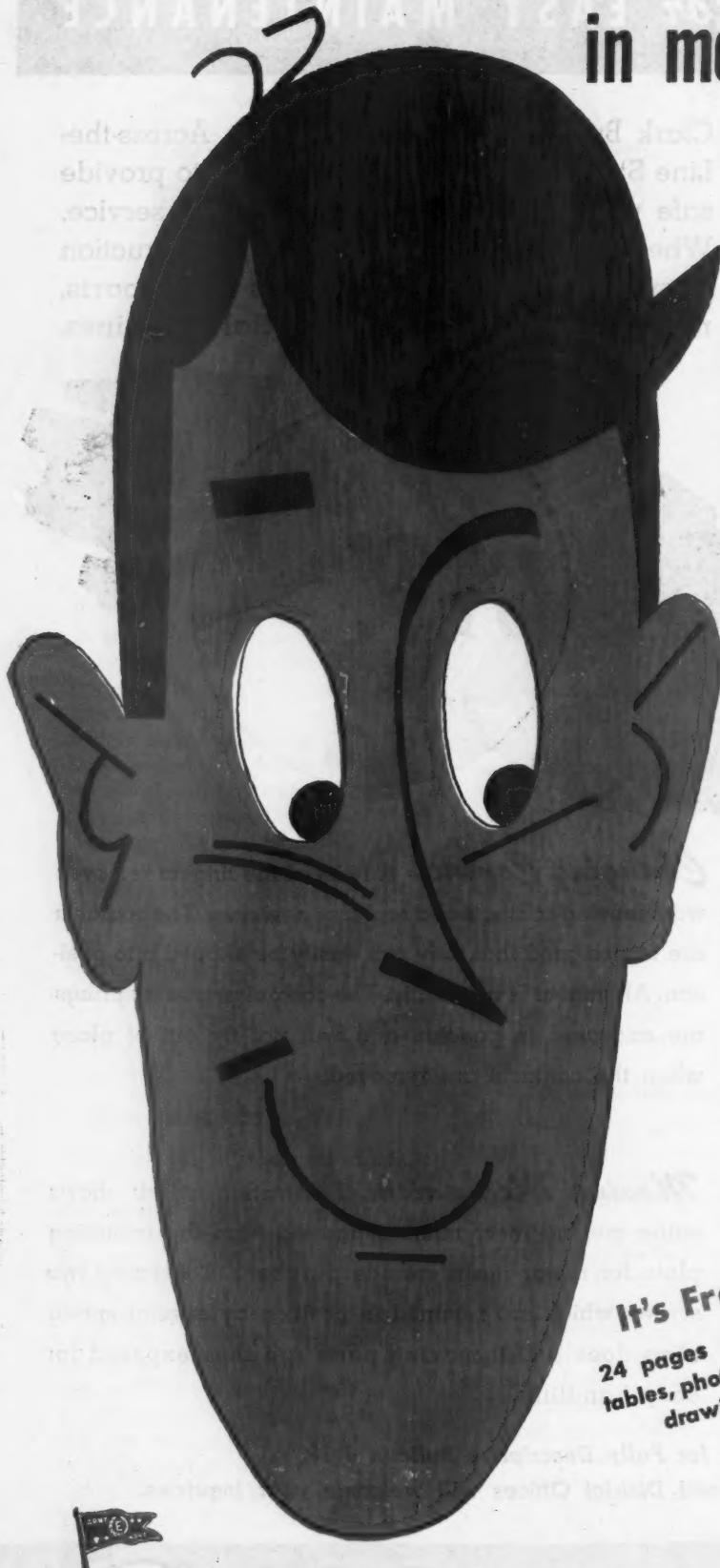


THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO • EVERYTHING UNDER CONTROL



How to be well read on the latest in motor-generator sets!



It's Free
24 pages of text,
tables, photographs,
drawings!



ROBBINS & MYERS • INC.

MOTOR DIVISION • SPRINGFIELD, OHIO
In Canada: Robbins & Myers Co., of Canada, Ltd., Brantford, Ont.

MOTORS • HOISTS • CRANES • MACHINE DRIVES • FANS • MOYNO PUMPS • FOUNDED 1878

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on you

Myers

covers

g sub-

vertical

or volt-

and di-

lates

years of

t.

it gives

power

integral

Motor

OHIO

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1878

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OHIO
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1878

st 1945

Ele

Leader... STEPS AHEAD!

*NOW... the new Stratoliner series
with... or without
a Germicidal unit*



**ANOTHER
LEADER
FIRST...**

**INCORPORATES EVERY KNOWN
FEATURE OF ADAPTABILITY FOR
INDUSTRIAL LIGHTING, A HEAVY
DUTY QUALITY UNIT.**

**Provision for a Germicidal Unit for im-
mediate or future installation.**

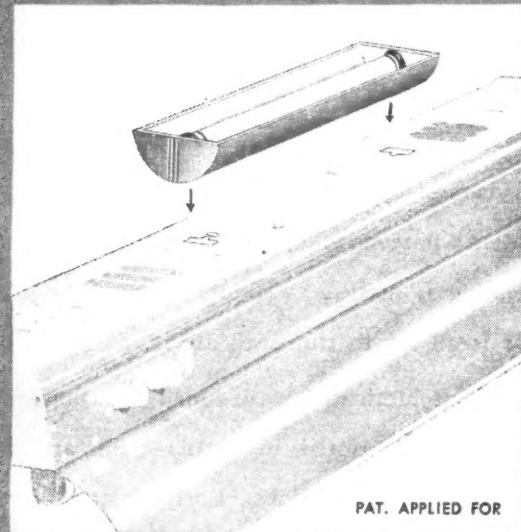
**Simple and efficient hanging arrange-
ments.**

**Individual or continuous row installations
easily installed by carefully worked out
accessories.**

**Four, eight and ten foot channels of one
piece construction with a reinforcing bead
to add rigidity and grip support for sliding
clamp hangers.**

**Blank section to provide for future lighting
requirements.**

**Two light sections or three light sections
incorporated with blank sections in order
to meet made to order lighting plans.**



PAT. APPLIED FOR

LEADER NO. GK 115 GERMICIDAL KITS are easily
installed on Stratoliner units. Available at small extra
cost, they contribute greatly to the health and effi-
ciency of personnel. Knockouts are provided on Stratoliner Channel, if ordered, for immediate or subsequent
installation of Leader Germicidal Kit.

LEADER ELECTRIC MANUFACTURING CORP.

6127 NORTH BROADWAY • CHICAGO 40, ILLINOIS
WEST COAST FACTORY: 2040 LIVINGSTON STREET • OAKLAND 4, CALIFORNIA

Installing 1945

Do not lubricate

Prelubricated ball bearings, now standard on Westinghouse CSP Motors up to 3 hp, require lubrication only after five years' or more service

Westinghouse Type CSP Motors, 3 hp and below, bought in 1945, will not require lubrication before 1950. Think of it! Five years of operation :: 24 hours a day :: with no attention whatever to lubrication. In 1950, inspect bearings. If greasing is needed—a simple disassembly job—and the motor is all set to run until 1955.

These prelubricated sealed ball bearings have been thoroughly field-tested in textile mills and in built-in machine tool installations. Early installations are still running on the original grease after seven years' service.

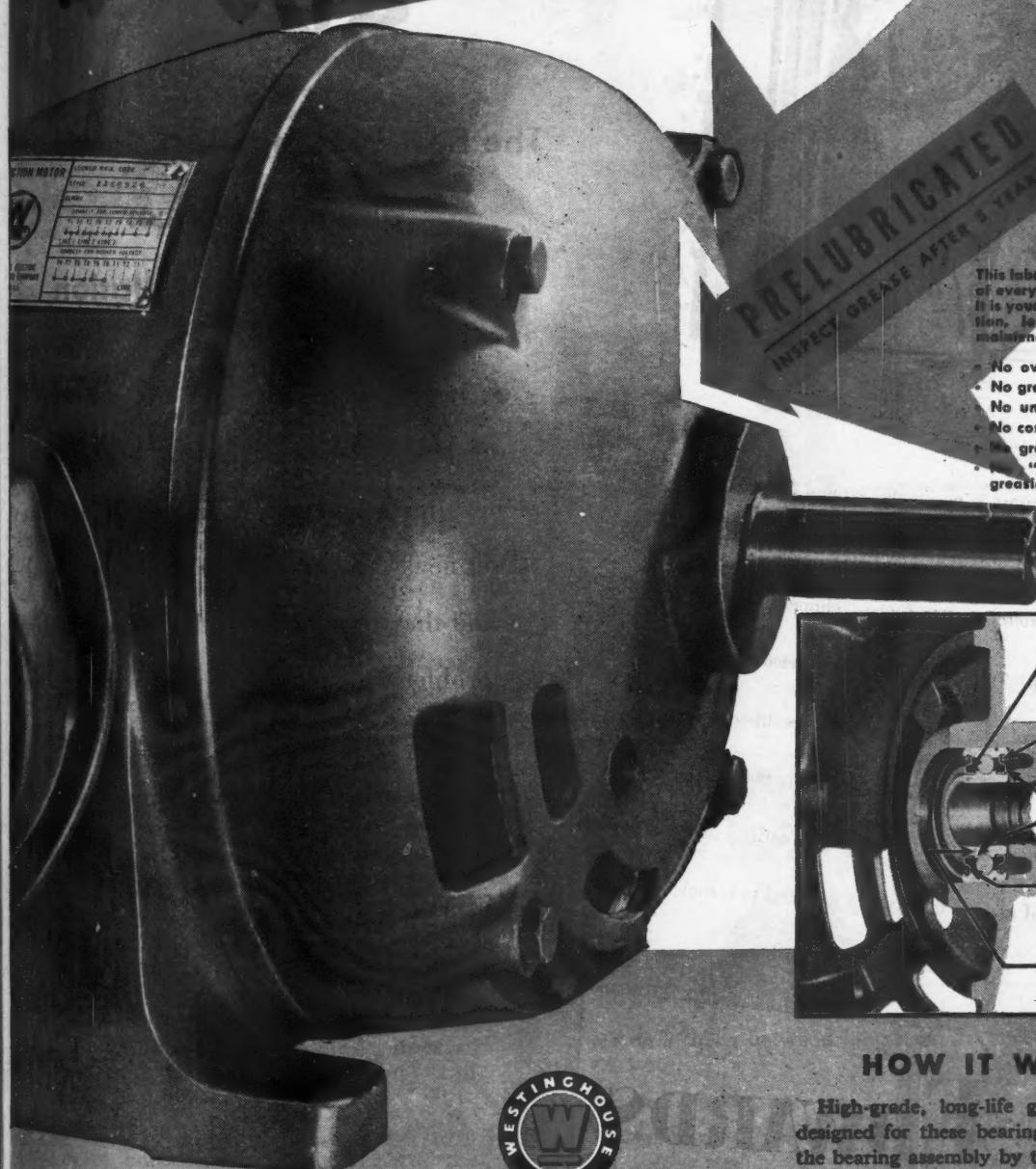
CSP motors may be mounted in any position, including the vertical. Wherever Class A insulation is applied, at least five years of operation without greasing may be expected. Applications in higher than normal ambient temperatures may require modified design.

For complete information, ask for DB-3100-CSP at your Westinghouse office. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-21326

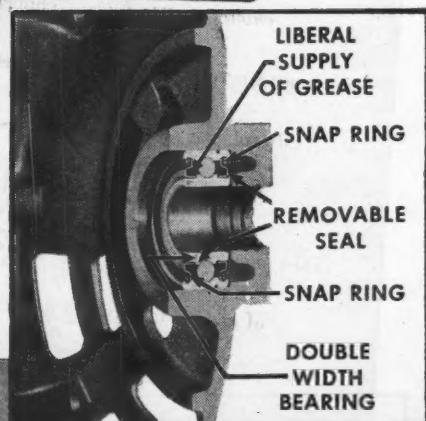


before 1950!



This label appears on the end bracket of every CSP motor up to frame 225. It is your assurance of smooth operation, long bearing life, and low maintenance. It also means:

- No overgreasing.
- No grease seepage into windings.
- No unreplaceable plugs.
- No costly lubricating schedules.
- No grease contamination.
- No "skipped" bearings while greasing.



HOW IT WORKS

High-grade, long-life grease, specifically designed for these bearings, is packed into the bearing assembly by the bearing manufacturer. This original grease is good for at least five years of normal service. Double-width, single-row construction permits a more liberal grease supply and better sealing than the single-width design. Two seal discs, locked into the outer race by snap rings, fit closely over the inner race to form a revolving seal.

When motor is disassembled for other reasons, this construction keeps dirt out of bearings just as effectively as the cartridge bearings now in common use.



Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

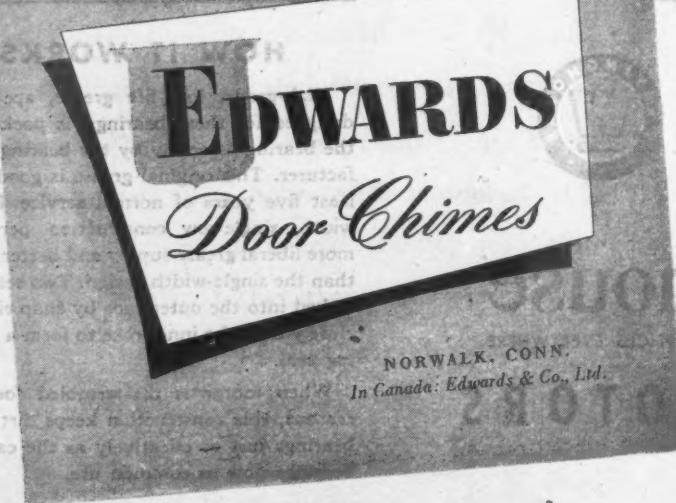
TYPE CSP MOTORS



COMING SOON!

**The Best Looking, Best Sounding
Chimes Built For
New Ease Of Installation**

*T*HERE is no greater symbol for the cheery warmth of hearth and home than the vibrant melody of chimes at your door... chimes that not only announce a hero's home-coming but welcome him back, as well. Edwards has always made chimes superlative in tone and loveliness. In the future they will be even more outstanding... with an entirely new conception of musical quality and designed to complement the décor of your home.



- Just as soon as restrictions permit, Edwards will start bringing out a completely new line of chimes. Watch for them! They set new standards of eye and ear appeal—and they're planned with the contractors' problems firmly in mind, to bring new ease of installation!

Promotion has already commenced—the advertisement shown here is just a starter—and it will continue in progressive volume, building up customer acceptance for you.

EDWARDS and COMPANY
Norwalk, Conn.

In Canada: Edwards & Co., Ltd.

HOLDENLINE CHAN'L-RUN

THE FRIENDLY LINE FOR THE CONTRACTOR



Electrical contractors are people—and are we glad? Because people are *friendly*, especially when they get hold of a line of lighting fixtures that some way or other seems to have been designed, friendly like, with the contractor's interests in mind.

- (1) Friendly to install quick with a minimum of labor costs.
- (2) Friendly to the bank account—because of complete and efficient product service—with profits that stick because they are not dissipated by service costs.

There's the story of HOLDENline in a few brief words. Challenge us. Make us submit proof if you wish.

HOLDENLINE PIXIES POINT TO FOUR CUSTOMER ADVANTAGES:

HOLDENline CHAN'L-RUN wins any contractor's admiration because it is beautifully engineered—along lines of strength, durability, simplicity and flexibility.

HOLDENline C-R gets a break with every contractor who appreciates the sweet, swift way it is convertible to continuous run—in double quick time. Individual, standard units fit every job. No fancy lengths.



1. No dark areas between lamps on 2½" centers with CS S-80
2. Ample wire freeway
3. No lamp or socket breakage—sockets are mounted on welded steel plate
4. High lighting efficiency—photometrically designed reflectors

Glad to send latest catalog. Ask for it.

SOLD THRU WHOLESALERS—OF COURSE

HOLDENLINE COMPANY

Pioneers in Fluorescent

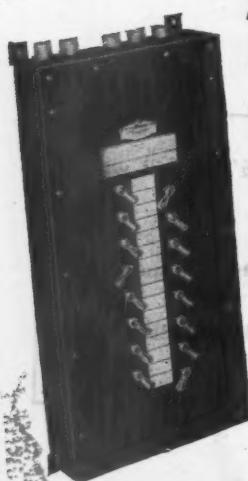
1963 EAST 57TH STREET • CLEVELAND 3, OHIO

Put your Panelboard "ON THE JOB"

Locate your panelboard in the center of the facilities it serves. Make it work for you by being accessible *when* and *where* you want it. It's more economical, too! Shorter electrical runs to lighting and receptacle outlets mean less wiring and lower voltage drop.

The **FA** Type AC THERMAG Circuit Breaker Column Type Panelboard is designed to fit 8", 9", or 10" H columns, or the narrow space between windows. This is the same **FA** THERMAG unit found in all **FA** Type AC Circuit Breaker Panelboards. The panelboard with the THERmal MAGnetic "brain" for double protection.

Available with 4 to 40 branches, with individual 15 to 50 ampere breakers, for single phase, 3-wire, 115-230 volts, or three phase, 4-wire, 120/208 volts solid neutral service. Tested by Underwriters' Laboratories for ten thousand complete operations.



Dust-Laden
Atmospheres
need **FA**

DUST-TIGHT PANELBOARDS

Wherever coal dust, grain dust or volatile materials fill the air, electrical circuits must be spark-proof. If you need new equipment get it now. Don't wait for trouble.

The **FA** Dust-tight Panelboard for lighting branch circuits of 50 amperes or less, and power panels from 50 to 600 amperes, 250 volts AC or DC, 600 volts AC, is Underwriters' approved for Class II, Groups F and G hazardous locations.

FA
NARROW COLUMN
PANELBOARD
Designed to fit
8", 9", 10" "H"
COLUMNS

Frank Adam
ELECTRIC COMPANY



When a small differential makes a big difference

SPECIFY TH TRANSTAT A.C. VOLTAGE REGULATORS

IDEAL AS COMPONENTS OR INDEPENDENT UNITS
RUGGED—WITHSTAND CONTINUOUS OPERATION
PROVIDE CONTINUOUSLY ADJUSTABLE VOLTAGE
MAINTAIN POWER FACTOR—WAVE FORM UNDISTORTED



TH TRANSTAT FOR .3 TO 20 KVA

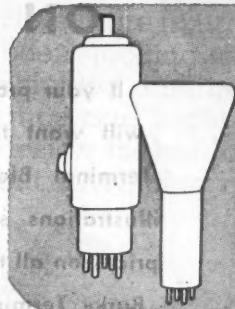
For 115, 230, 460 v. single and polyphase circuits. Maintain voltages within a narrow range in changing from no load to full load. Varnish impregnated for high turn, layer and sectional insulation. Long brush with low current density for cooler operation. Maintain brush setting when mounted in any position. Ask for Bulletin 51-2

NEW TH 2½A TRANSTAT

One piece brush arm has large heat dissipating surface; operating shaft quickly changed for table, panel or gang mounting. Varnish impregnated core and coil. Plastic base has terminal barriers, provides base to base mounting in dual units. Single units 300 VA, dual 520. Wgt. 5½ to 13½ lbs. Ask for Bulletin 171-01.

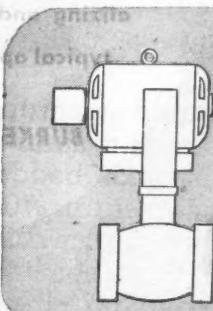
AMERICAN TRANSFORMER COMPANY, 178 Emmet St., Newark 5, N. J.

Electrical Contracting, August 1945



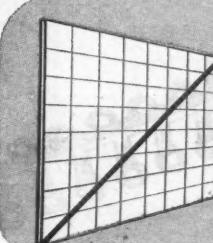
PRODUCTION TESTS

Smooth voltage control in production testing of electronic tubes can be provided with Transtat voltage regulators. Easy to operate—long, trouble-free life.



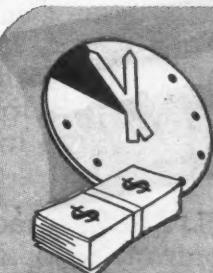
TEMPERATURE OR SPEED CONTROL

Electric-furnaces, soldering apparatus or other electric heat-treating devices may be controlled smoothly and quickly by Transtat regulators. Voltage sensitive AC motors can be regulated to selected RPM—efficiently and economically with a Transtat.



SMOOTH COMMUTATION

The wide brush tract of evenly spaced segments separated by solid insulation provides an ideal commutating surface.



HIGH EFFICIENCY

Transtats' transformer efficiency costs less in the long run than resistive control. High dimensional uniformity, flexible mounting speed assembly.

AMERITRAN

MANUFACTURING SINCE 1901 AT NEWARK, N. J.

Pioneer Manufacturers of Transformers, Reactors and
Rectifiers for Electronics and Power Transmission





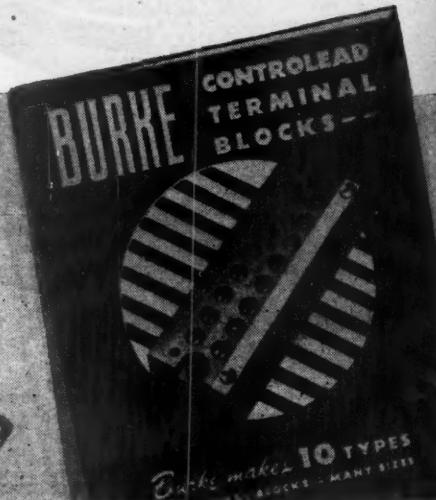
NEW Catalog AVAILABLE ON BURKE TERMINAL BLOCKS

If your problem is control circuit design, layout, or installation, you will want this new informative bulletin on Burke Molded Bakelite Terminal Blocks. The Bulletin contains actual size cross sectional illustrations showing detail construction features, with dimension and prices on all types and sizes.

Burke Terminal Blocks provide a simple method of identifying, section- alizing and terminating intricate control circuit wiring—a few of the typical applications are listed below. Prompt deliveries are being made.

Write for your copy of booklet TB-3.

BURKE ELECTRIC COMPANY • 1358 W. 12th STREET • ERIE, PA.



» A FEW Typical USES

Electronic Control Systems • Radar Equipment • Radio Receiving and Transmitting Sets • Telephone and Telegraph Switchboards • Load Dispatching Signal Systems • Fire and Police Signal Systems • Traffic Signal Systems • Machine Tool Control • Voltage Regulator Equipment • Switchboards of all kinds • Automatic Welding Control • Induction Heating Control



MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • Since 1891

SPERO announces a NEW low-priced Commercial Fluorescent Luminaire

Here is the fixture your customers have been looking for—a low-cost glass shielded luminaire of smart appearance and high efficiency. Simplified design makes low-price possible without sacrificing quality.

SPERO CVG-448 —glass shielded

Made for four 40W tubes. High efficiency with low intrinsic brightness is achieved by panels of specially selected "Claralite" ribbed, ceramic-coated glass having 80% transmission factor and superior diffusing qualities. Reflecting surfaces finished in "Plastox" white. Glass is easily removed for cleaning or servicing lamps. New simplified method of installation for either stem or ceiling mounting. Attractive streamlined canopy furnished for stem mounting.

SPERO CV-448 —unshielded

The same fixture is designed for effective use without glass, where desired. Illustration at left shows that it is a highly attractive unit for any commercial or semi-commercial installation.

Spero INSTA-LITE, providing instantaneous starting, optional on both models at slight extra cost.

Write for descriptive bulletin.

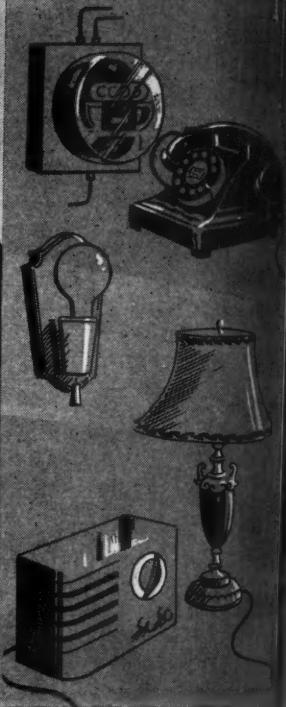
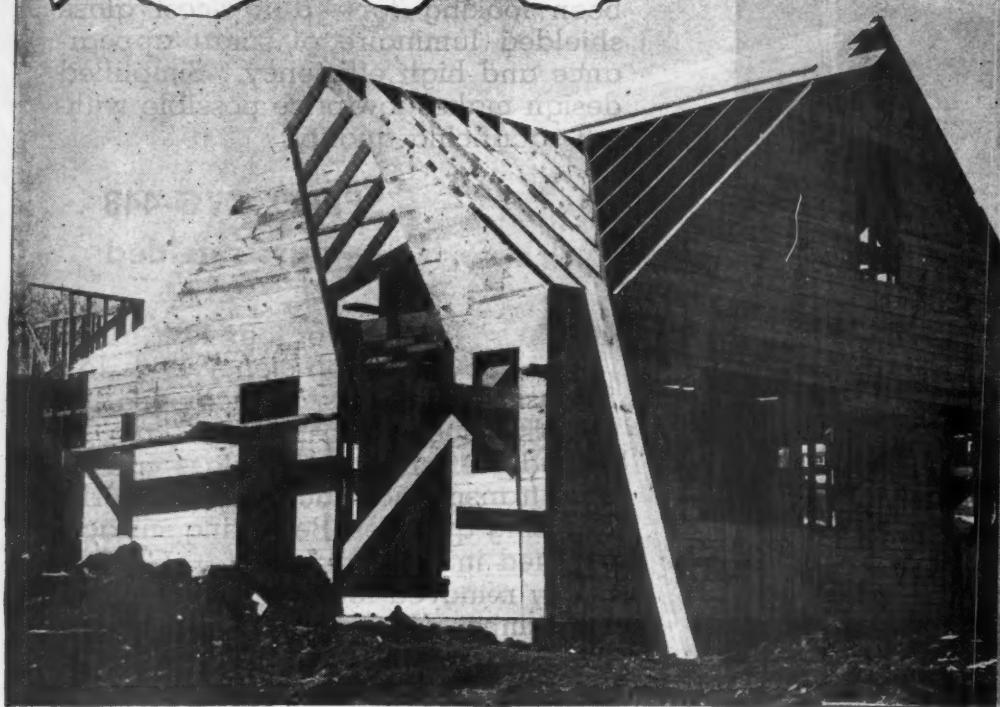
Also
available with
INSTA-LITE
gives you Instant Starting
and Instant Lighting with
NO starting switch



THE SPERO ELECTRIC CORPORATION
18222 LANKEN AVE. ★ CLEVELAND, OHIO

What types of wire insulated with Geon should be used in this home?

OF HOUSE WIRE TW HOUSE WIRE
UNDERGROUND SERVICE
ENTRANCE CABLE
APPLIANCE CORD LAMP CORD
Fixture WIRE RADIO WIRE
TELEPHONE WIRE



THE coming construction boom will bring with it a boom in the use of wire and cable insulation made from GEON polyvinyl materials. That's because GEON is being used as insulating material for *all* types of domestic wiring with the exception of cord for certain types of heating units such as toasters, roasters, irons or home heaters. And there's reason to believe that these applications may soon be on the list.

The versatility of insulation made from GEON is graphically demonstrated by its use for underground power cable on the one hand and as "spaghetti" for fine radio wire on the other.

The use of wire insulation made from GEON will bring with it many advantages in addition to GEON's excellent electrical properties. Ease of installation, for example, is one; and resistance to water, chemicals, air, aging, ozone, abrasion, heat, cold and many other normally destructive factors. Insulation made from GEON may be colored in the entire NEMA range.

Specify insulation made from GEON when you order from your manufacturer or wholesaler. Or for information regarding special applications, write Department YY, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

Geon
Polyvinyl Materials

B. F. Goodrich Chemical Company

A DIVISION OF
THE B. F. GOODRICH COMPANY

Electrical Contracting, August 1949

HAND IN HAND WITH FLOODLIGHTING IS Automatic CONTROL . . .



SANGAMO TIME SWITCHES

There are types to meet every protective lighting control need. The complete line includes Astronomic Dial, Synchronous Carry-Over, and Outdoor Time Switches. Form VSWZ Astronomic Dial Synchronous Carry-Over Time Switch is shown above. Current interruptions up to 10 hours will not stop it nor affect its "on" and "off" settings.



FLOODLIGHTING is excellent night-time protection for property—but in this type of protection there is a particular need for SANGAMO TIME SWITCHES. The reason is simple—this Automatic Control means that the floodlighting is turned on and switched off at the correct times. There are no slips in timing—no human error can creep in.

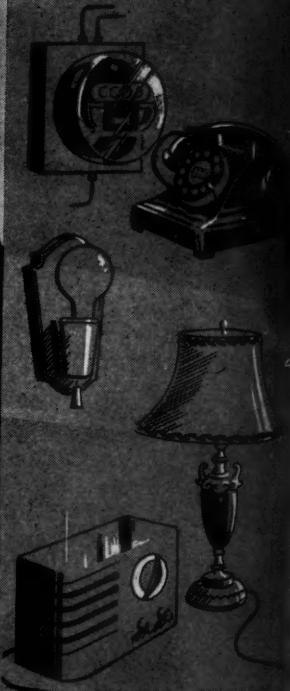
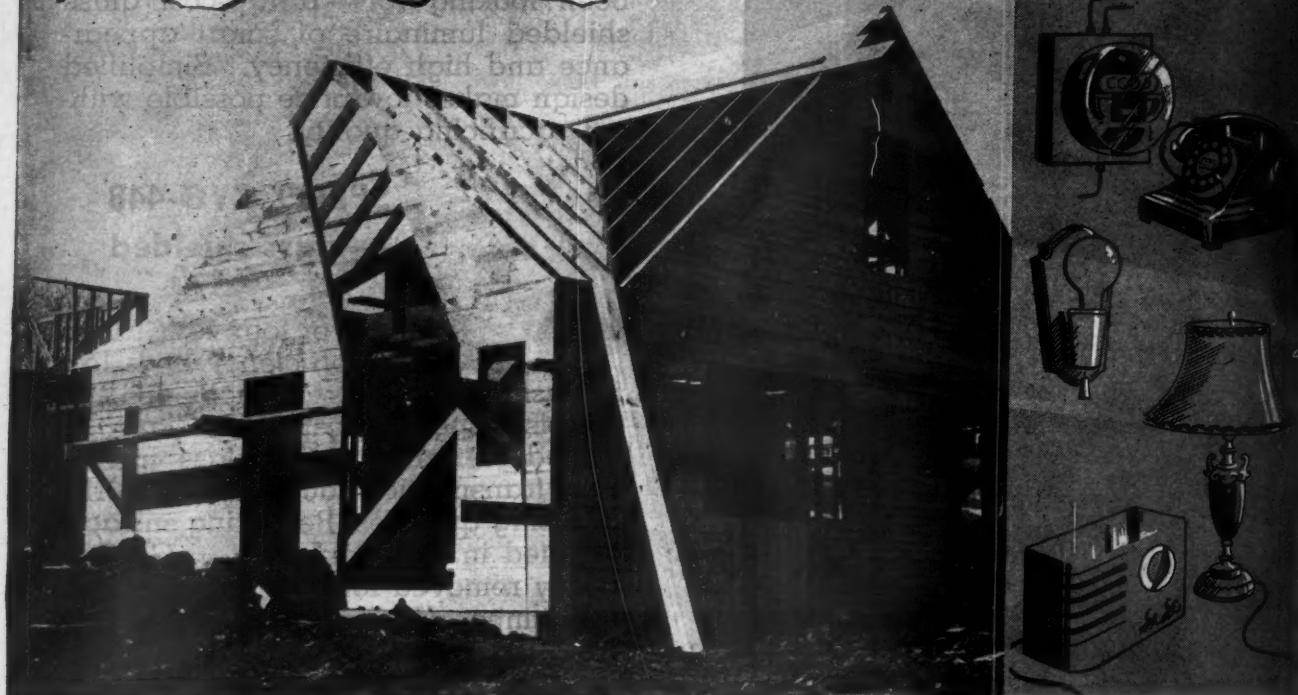
Tell this to buyers of floodlighting and they will be customers for SANGAMO TIME SWITCHES . . . so will present users of floodlighting who at present are not acquainted with the Automatic Control.

WHERE THERE IS A NEED FOR FLOODLIGHTING...THERE'S A SALE FOR AUTOMATIC CONTROL...

SANGAMO ELECTRIC COMPANY SPRINGFIELD
ILLINOIS

What types of wire insulated with Geon should be used in this home?

CT HOUSE WIRE TW HOUSE WIRE
UNDERGROUND SERVICE
ENTRANCE CABLE
APPLIANCE CORD LAMP CORD
FIXTURE WIRE RADIO WIRE
TELEPHONE WIRE



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Geon
Polyvinyl Materials

B. F. Goodrich Chemical Company

A DIVISION OF
THE B. F. GOODRICH COMPANY

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WHERE THERE IS A NEED FOR FLOODLIGHTING . . . THERE'S A SALE FOR AUTOMATIC CONTROL . . .

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

Don't Overlook These Profits On Your Very Doorstep!



WEBSTER ELECTRIC
teletalk
REG. U. S. PAT. OFFICE

... Adds hours to your work week

There is no more logical adjunct to the electrical contracting business than the promotion and sale of Teletalk Intercommunication Systems. For Teletalk is primarily an electrical device of almost unlimited potential marketing possibilities.

Right in your own town . . . your own neighborhood . . . on your very doorstep . . . are business concerns such as offices, stores, banks, factories—all in need of this outstanding system of voice-to-voice communication between individuals and departments. Every business house, hospital, school, and institution suffers from wasted time, lost energy, con-

fusion and delays caused by needless running around. Teletalk can—and does—end these costly practices.

Teletalk is modest in first cost; is quick and easy to install; is powered from the regular light circuit; requires little or no servicing. Made in types and models for every need. You, as an electrical contractor, are in an ideal position to take advantage of this big, close-by, profitable market by selling Teletalk as a regular part of your business. It's a "natural" for the progressive electrical contractor. Write for catalog and full information.

Let's All Back the Attack
Buy Extra War Bonds



Licensed under U. S. Patents of Western
Electric Company, Incorporated, and Amer-
ican Telephone and Telegraph Company

WEBSTER ELECTRIC

Recine, Wisconsin, U.S.A. • Established 1909 • Export Dept.: 13 E. 40th Street, New York (16), N.Y. Cable Address "ARLAB" New York City

"Where Quality is a Responsibility and Fair Dealing an Obligation"



TO SAFEGUARD

is also the purpose of Shawmut THERM-A-TRIPS. They protect motors, circuits, and equipment. They avoid needless shutdowns. Their long, safe time-lag allows motors to start and run on normal overloads; but they blow at once on excessive overloads and short circuits. They occupy a small space, are inexpensive, need no attention, can be instantly replaced; and no other overload protection is needed. Three types: knife-blade, ferrule, and plug. Protection with THERM-A-TRIPS is positive protection — the kind you want. Make sure you specify them.



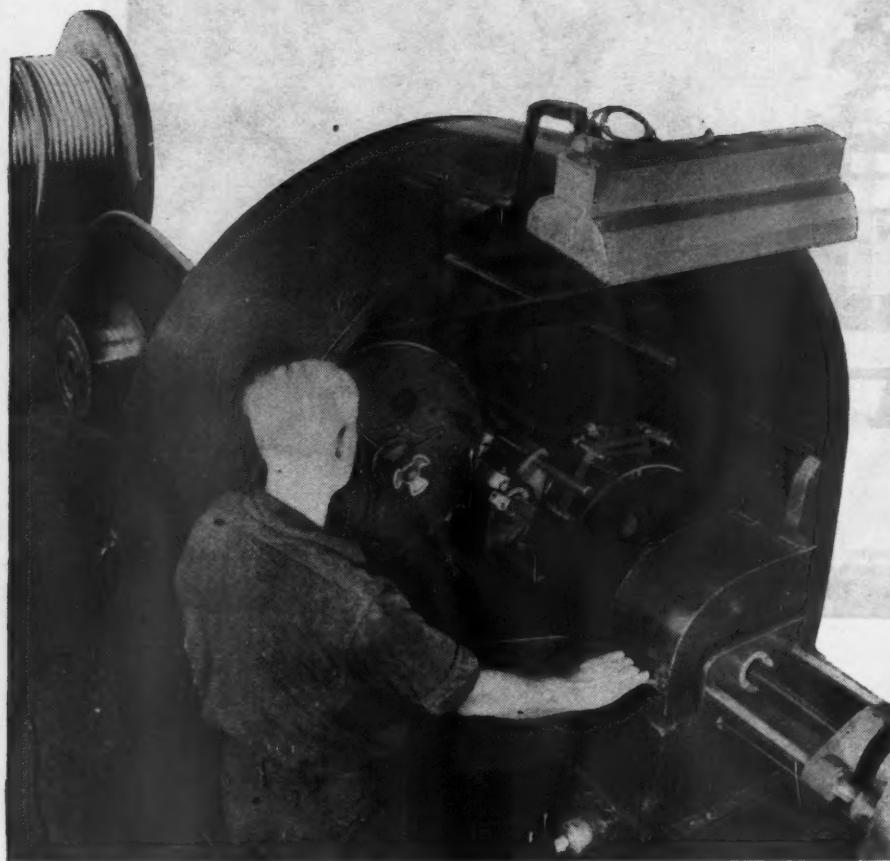
THE CHASE-SHAWMUT COMPANY
NEWBURYPORT, MASSACHUSETTS

FUSE MAKERS

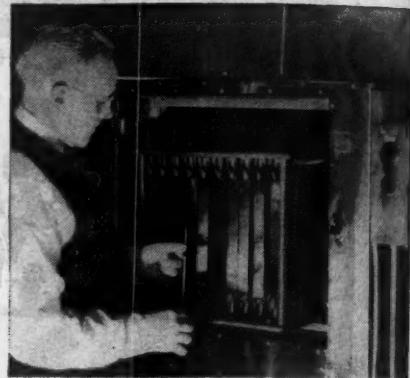


SINCE 1893

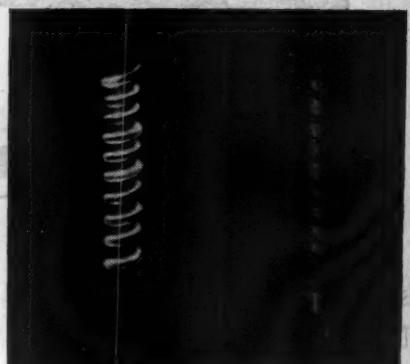
Is your power system suffering



Newly designed equipment and experienced operators apply these improved tapes to the cable insuring proper tension, correct angle of application and proper control of tape position.



Heat test. Precisely controlled ovens subject varnished cambric to aging tests far in excess of normal requirements.



Corona discharge eliminated by conducting rubber. Left—cable insulated with ordinary rubber; note corona. Right—same cable protected by conducting rubber—no corona.



Types of Varnished Cambric Cables

- Single-conductor series street lighting cables.
- Multiple-conductor non-leaded and unarmored cables.
- Control cables with combination of different colored braids.

- Single-conductor lead-sheathed cables.
- Single-conductor non-leaded cables.
- Multiple-conductor lead-sheathed or metallic-armored cables.

from War Fatigue?

Let these husky new Varnished Cambric Cables shoulder the heavy loads

SOME products have been greatly improved during the war. Among them are U·S·S American Varnished Cambric Cables. In many respects, the characteristics of varnished cambric insulation lie between those of rubber and impregnated paper.

The improved type of varnished cambric now employed by the American Steel & Wire Company is highly resistant to heat. It is recommended for operating temperatures up to 85°C. In this respect it is notably superior to rubber. For working voltages of 5000 or less, it may be safely operated at the same maximum temperatures usually recommended for paper insulation.

In dielectric strength, varnished cambric is superior to rubber but not equal to impregnated paper. Compared to rubber, thinner walls of varnished cambric insulation may be employed for a given voltage. Where space is at a premium,

new varnished cambric cables, with greater current carrying capacity, can be installed in the same space occupied by the old cables.

Cables with varnished cambric insulation are easier to handle and simpler to install than paper insulated cables—the high degree of skill and experience required for jointing and terminating paper cables is not required for varnished cambric cables.

The fact that oil and grease do not injure varnished cambric insulation is another important advantage that recommends it for many purposes. Varnished cambric has less moisture resistance than rubber; and for damp locations, it requires a waterproof covering such as a lead sheath.

For complete information on U·S·S American Varnished Cambric Cables, write for our new catalog.

American Steel & Wire Company

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, Pacific Coast Distributors

United States Steel Export Company, New York

UNITED STATES STEEL

Where American Varnished Cambric Cables offer definite advantages

IN MODERATE OR LOW VOLTAGE INSTALLATIONS where its superior heat resistance permits greater current carrying capacity for a given copper area.

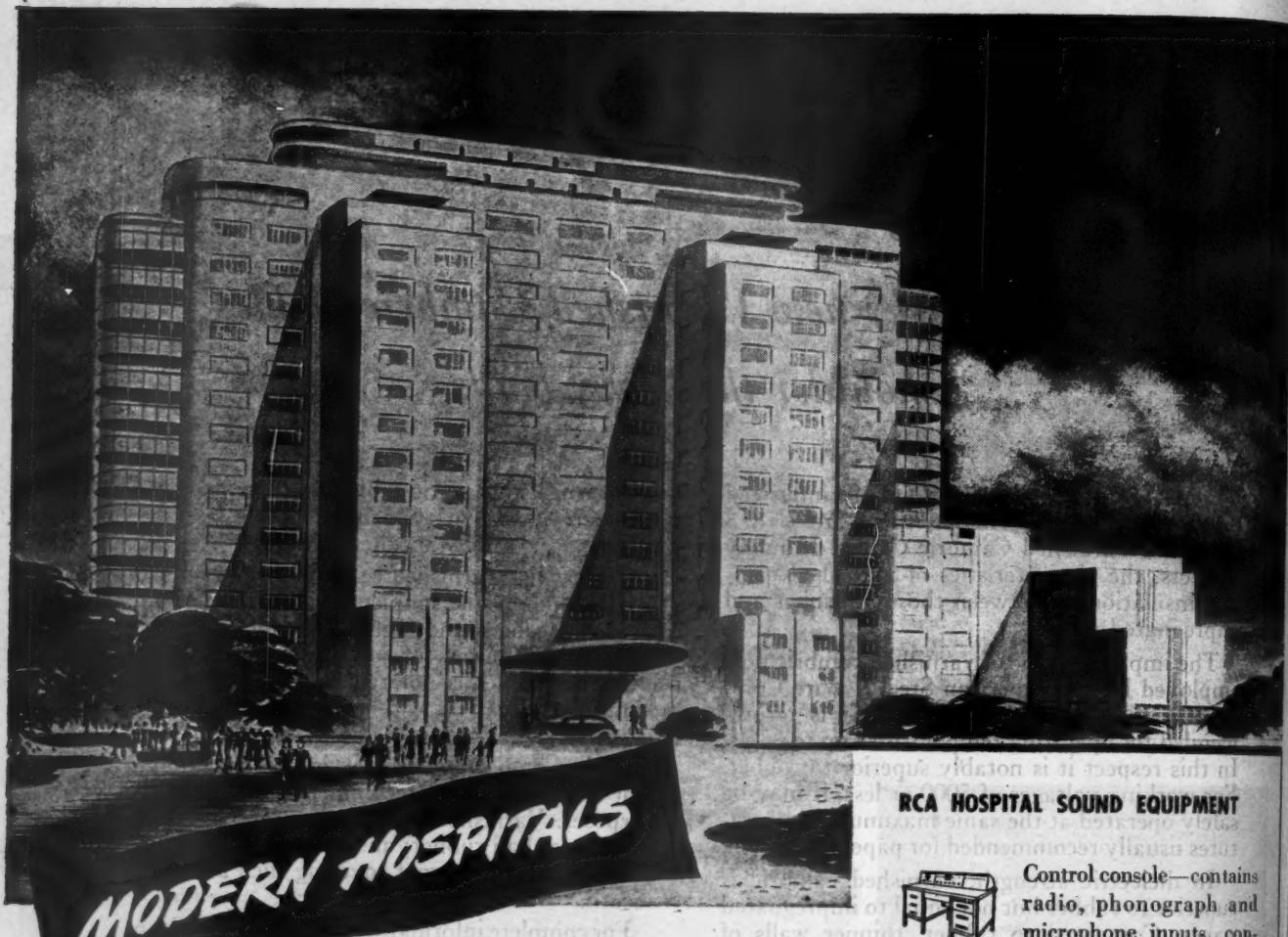
IN POWER PLANTS for general wiring and such applications as insulated bus bars, motor and

generator leads, connections for oil switches, transformers and voltage regulators.

IN MANUFACTURING PLANTS, especially where heavy loads must be transmitted for short distances.



U·S·S American Varnished Cambric Cables



MODERN HOSPITALS

USE RCA SOUND SYSTEMS TO SIMPLIFY ADMINISTRATION

RCA Paging facilities locate personnel efficiently, without delay... **Selected Music** sent to any part of the hospital cheers and soothes patients, relieves the tedium for convalescents, entertains the staff, off duty... **Sound Reinforcing** in the auditorium or chapel makes broadcasts of lectures and religious services possible... **Intercommunication facilities** place superintendent, doctors, nurses and other members of the staff in instant touch with each other, linking all key departments.

RCA has Sound Systems, Centralized Radio and Intercommunication Facilities for every hospital need. Design sound into your plans for new buildings and remodeling. If you need assistance with your project, call an RCA Sound Specialist, or write Department 70-136BR, Sound Equipment Section, Radio Corporation of America, Camden, New Jersey.

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LEADS THE WAY... In Radio... Television... Tapes... Phonographs... Records... Electronics

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RCA HOSPITAL SOUND EQUIPMENT



Control console—contains radio, phonograph and microphone inputs, control and selector switches.



Speakers—wall cabinet and flush mounted type for inside use; horn baffle type for outdoor use.



Headphone and program selector station—for individual use of patients.



Microphones—dynamic and velocity types in either table or floor stand mountings.



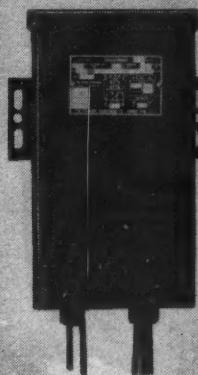
Intercom units—for communication between key persons and departments.



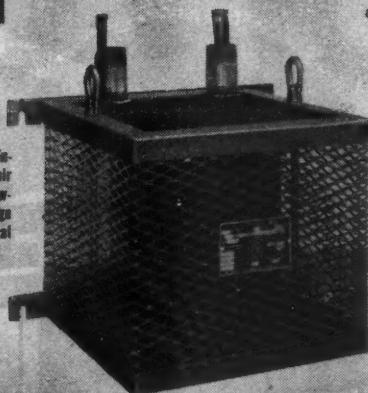
16MM Sound Projector—for screening educational or entertainment films for staff and patients.

when *plant* conversion means *power* conversion

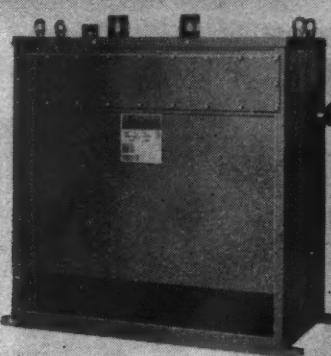
This 250 KVA ASKAREL filled transformer may be placed anywhere in the plant without special fireproofing.



Moisture-proof, compound filled type for operating small motors and lighting. Can be wall mounted or attached to machine.



For wall mounting above individual machines, dry type air cooled transformer will handle power and lighting from higher voltage plant distribution circuits. Typical design of 15 to 50 KVA rating.



Dry type air cooled transformer, ideal for load center location. This design is available up to 1,000 KVA in voltage ratings to 4800.

use STANDARD TRANSFORMERS

Rearrangement and replacement of plant machinery generally offers many opportunities to effect economies through revamped electrical arrangements. In many cases, transformers can be employed to reduce costs or to improve operations. One example is where long runs of expensive low-voltage wiring can be replaced by high-voltage circuits with individual transformers at the driven machines. In other cases, distribution transformers can be advantageously placed at the load center, with

resulting increased efficiency and lower operating cost on machines.

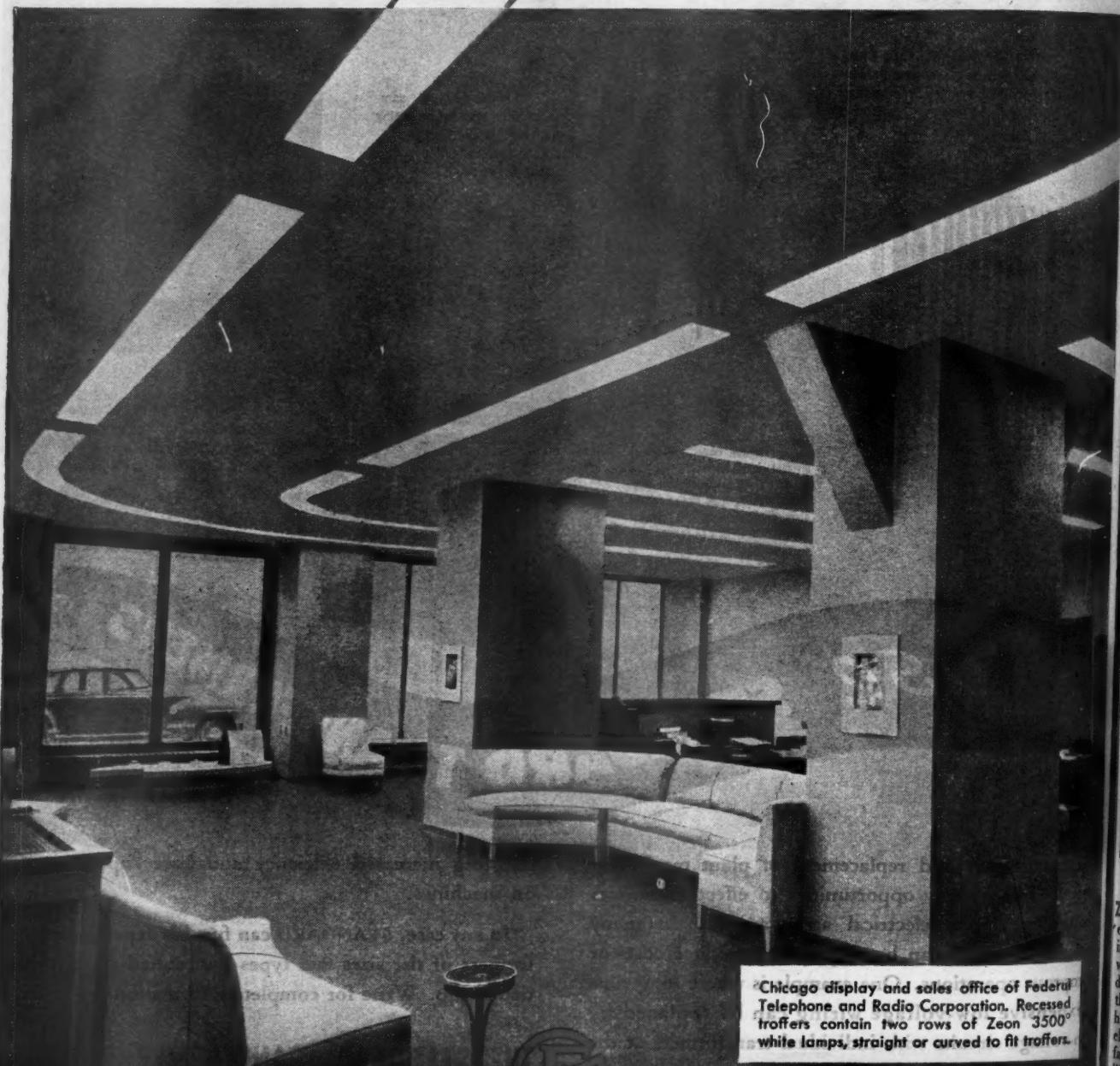
In any case, STANDARD can furnish dependable transformers of the sizes and types best suited for your particular job. Write for complete information.

THE STANDARD TRANSFORMER COMPANY
WARREN, OHIO . REPRESENTATIVES IN PRINCIPAL CITIES

Standard
TRADE MARK
MAKERS OF TRANSFORMERS FOR:

DISTRIBUTION, POWER, STREET LIGHTING,
METERING, TESTING, DRY AND LIQUID FILLED TYPES
OVER A QUARTER CENTURY OF EXPERIENCE SPECIALIZING IN DESIGNS TO MEET USERS SPECIFICATIONS

new why cold cathode fluorescent lighting



Chicago display and sales office of Federal Telephone and Radio Corporation. Recessed troffers contain two rows of Zeon 3500° white lamps, straight or curved to fit troffers.



FEDERAL ELECTRIC COMPANY, INC.

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TELEPHONE VINCENNES 5300

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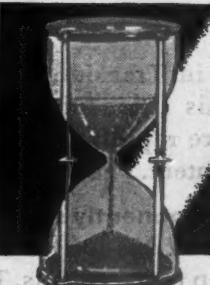
Gives Longer Life

102 YRS. AM

WHEN you specify fluorescent, specify the kind that offers the greatest flexibility, the lowest maintenance cost, the longest life. Zeon Cold Cathode lamps are made in a wide range of types, sizes, and colors. Intensity can be controlled with a dimmer in a series circuit. Lamps are rated at 10,000 hours—and start instantly. This life rating is not limited by any number of starts.

Investigate Zeon. Federal Electric lighting engineers will be glad to give you unbiased information, to help you check your plans, to be sure you have the right amount, type, and color of light and the best location for fixtures. Call or write any branch office, or Federal Electric Company, Inc., 8700 South State Street, Chicago 19, Illinois. Address "Lighting Information Service."

Why Longer Life...



ZEON ELECTRODES Shell electrodes, of pure Swedish iron, strike the arc instantly without heating, flicker, or delay. No starter is used; there is no filament to be heated. These Zeon shell electrodes last indefinitely—far beyond the 10,000-hour life rating of Zeon Cold Cathode fluorescent lamps.

AGING AND TESTING After sealing, lamps are operated for a specified time. While aging, they are checked for any possible leaks and darkening, and for light intensity and color. Lamps that pass the tests are ready for shipment—ready to start upon their long life, which means fewer lamp replacements, and substantially lower maintenance costs.



CIRCUITS Zeon Cold Cathode lamps may be operated on high voltage series circuits up to 100 feet of lamps; or on low voltage multiple circuits; or on small ballast transformers at voltages practically the same as those for hot cathode lamps. In any case, Zeon Cold Cathode fluorescent lamps start instantly, without delay, without flicker.

ASK FOR "Lighting Information Service"

You are invited to submit your problem in detail. Federal Electric lighting engineers will make a sincere effort to help you with your plans, in cooperation with your architect, consulting engineer, and electrical contractor, so that you may get the best possible results from whatever fluorescent lighting you install. There is no obligation for this service, except your cooperation in helping us to help you. Write Federal Electric Company, Inc., 8700 South State Street, Chicago 19, Illinois.





HERE'S a ductway which effectively withstands the corrosive action of all types of soil normally encountered in cable installation.

This advantage of Transite Ducts is shown in a series of tests conducted over a two-year period by an independent research agency. Through cinder fills, salt marshes, peat bogs, clay, loam and many other aggressive soils, laboratory men found that these asbestos-cement ducts actually became stronger, more durable with age.

As an added factor, underground cables

encased in Transite are *cooler* cables because this inorganic material dissipates heat more rapidly than ducts with an organic content. Thus cable life is lengthened.

The permanently smooth bore of Transite Ducts makes long cable pulls easy and speeds up replacements. These ducts come in long, lightweight lengths, easy to handle and install.

* * * * *
For details, write for Data Book,
DS410, Johns-Manville, 22 E.
40th Street, New York 16, N.Y.



Johns-Manville

There is an office near you

TRANSITE DUCTS
CONDUIT for use without concrete
KORDUCT for concreting in

A TRACE OF



and Burndy adds 20% to the strength of cast electrical CONNECTORS

U O T N H E R E



Continuing its leadership in connector development, Burndy now supplies cast electrical connectors made from Burndy alloy #113L . . . a new high-copper alloy containing *Lithium. This important addition of Lithium, in correct amount, provides denser, finer grained castings . . . with tensile strength increased 20%, elongation increased about 20%, and coefficient of friction materially reduced.

Thus today, Burndy cast electrical connectors provide an even greater margin of superiority than in the past. Far stronger and tougher, they can be installed with greater applied pressure, and are more readily conformable to the conductor . . . assuring a tight, durable, full-contact-area connection.

For complete information on these or any other type of electrical connectors, write connector headquarters . . . Burndy Engineering Co., Inc., 107-D Bruckner Boulevard, New York 54, N. Y.

Headquarters for
CONNECTORS

Burndy

In Canada: Canadian Line Materials, Limited, Toronto 13



Wiring for convenience and economy of maintenance in hotel rooms requires ample outlets, properly placed, for floor, desk and bed lamps . . . fans and appliances . . . located with special regard to the comfort and safety of guests. This photograph shows how Plugmold, installed above the baseboard, is being specified for this purpose by an increasing number of hotel operators.

WHERE TO USE IT

What to use -



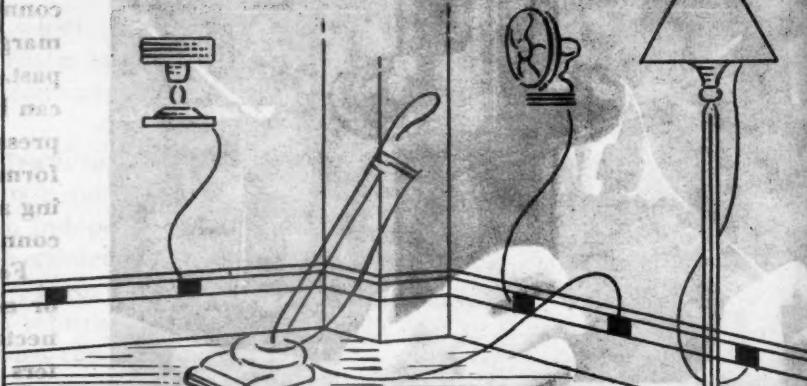
2127

PLUGMOLD

No. 2100 Plugmold—Capacity: 6 No. 12 R.C. Conductors with receptacles installed; 10 No. 12 R.C. Conductors without receptacles.

Diagrammatic drawing shows typical installation of Plugmold No. 2100 in hotel rooms. Outlets may be located exactly where required and in the number required for adequate service. When re-decorating, or re-arranging rooms the location of outlets or the number of outlets may be changed without disturbing the basic installation . . . making Plugmold an extremely economical long range investment from the maintenance point of view, eliminating hazardous long extension cords and the pilferage of plugs and accessories that has in the past proved a costly item.

HOW TO USE IT



ELECTRICAL CONTRACTORS

Business publications like these, with aggregate circulation of over 240,000 monthly among your prospects and customers, carry Wiremold advertising messages designed to HELP YOU BUILD BUSINESS. Tie in with this aggressive promotion program.

THE WIREMOLD COMPANY
Hartford 10, Connecticut



KNOW YOUR **WIREMOLD** . . .

BUSINESS BUILDER IN TOMORROW'S MARKET FOR ADEQUATE WIRING

SOLD THROUGH ELECTRICAL WHOLESALERS . . . INSTALLED BY ELECTRICAL CONTRACTORS . . . EVERYWHERE



housecleaning recommended



Remove temperature-
raising "dust" overcoats
for top performance
of breakers and switches

AVOID THIS . . .

Too much dust is accumulated on these switches and starters. Dust forms a heat-insulating "overcoat" which prevents normal heat radiation and raises operating temperature.

Westinghouse Recommends These Steps when Inspecting Safety Switches

1. Make sure disconnect ahead of switch is open.
2. Clean contacts, and check for alignment and proper pressure on hinge and break lugs. Apply light coat of sludge-free lubricant.
3. Remove and clean fuse contacts with fine sandpaper; check fuse ratings; tighten fuse contacts.
4. Clean switch base and insulating parts.
5. Make certain cable connections and lugs are tight.
6. Check switch for smooth operation and clearance of arc extinguisher, safety shields, etc. Lubricate operating mechanism.
7. Keep cabinets clean and free from rust—and keep covers closed.



MANUAL

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

In the urgency of war production, inspection and cleaning of vital controls, such as enclosed breakers and safety switches, may have been overlooked. Because these are vital links in your plant power distribution system, Westinghouse recommends periodic inspection and "housecleaning".

Benefits are manifold: reduced maintenance, higher operating efficiency and safety standards, protected investment, and not least... increased production.

Safety switches and Type AB-I circuit breakers are only two items of the Westinghouse complete line of standardized control. For any control, call your Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60605

21001 AB-I BREAKERS AND SAFETY SWITCHES

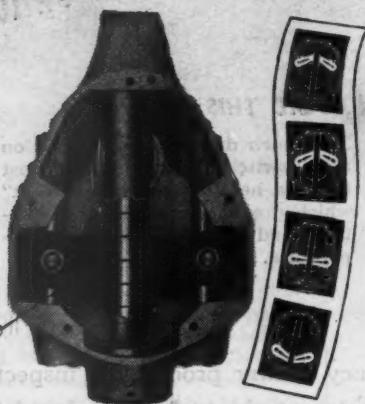


MAKES HOLES FASTER IN...
STONE..WOOD..METAL



PORTABLE ELECTRIC
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HERE'S WHY



**"SLING-SHOT" DRIVE
PACKS MORE POWER**

The Thor Hammer's exclusive and radically different "Sling-Shot" Drive is a tough, shock-proof rubber connection that drives the piston in powerful hammer action. It delivers 1600 powerful piston blows per minute for drilling with up to 1" dia. star drills.

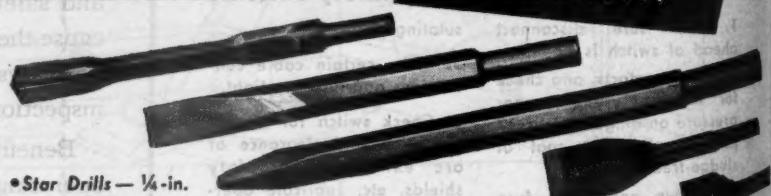
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600 West Jackson Blvd., Chicago 6, Illinois
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Save Hours and Dollars on
Maintenance and Installation

Where repair or construction jobs require star drilling, demolition, cutting, shaping, chipping, scaling or gouging in stone, wood or metal, you can get it done faster and easier with a Thor Portable Electric Hammer. Compact and light, this tool delivers a more powerful blow than any hammer of comparable size and capacity. Completely different in design and construction, the Thor Electric Hammer will stand up for long, dependable service. Get the facts from your Thor distributor.

THESE MANY
HAMMER TOOLS
MULTIPLY ITS
USEFULNESS OVER
AND OVER...



• Star Drills — 1/4-in.
to 1-in. diameter,
with drilling depths
up to 24 inches for
work in stone, con-
crete, brick and com-
positions.

• Chisels — up to 12-
in. long for chipping,
channelling, cutting,
gouging in all ma-
terials.

• Bull Points — For
general demolition
and breaking-up
walls and floors,
streets and sidewalks
in installation or
maintenance work.

Wood Chisels
Flat and curved wood
chisels for shaping,
cutting and gouging
wood on construction
and installation.

Scaling Chisels

Heavy-duty metal
and stone scaling
and cleaning chisels
in a variety of widths
and lengths.

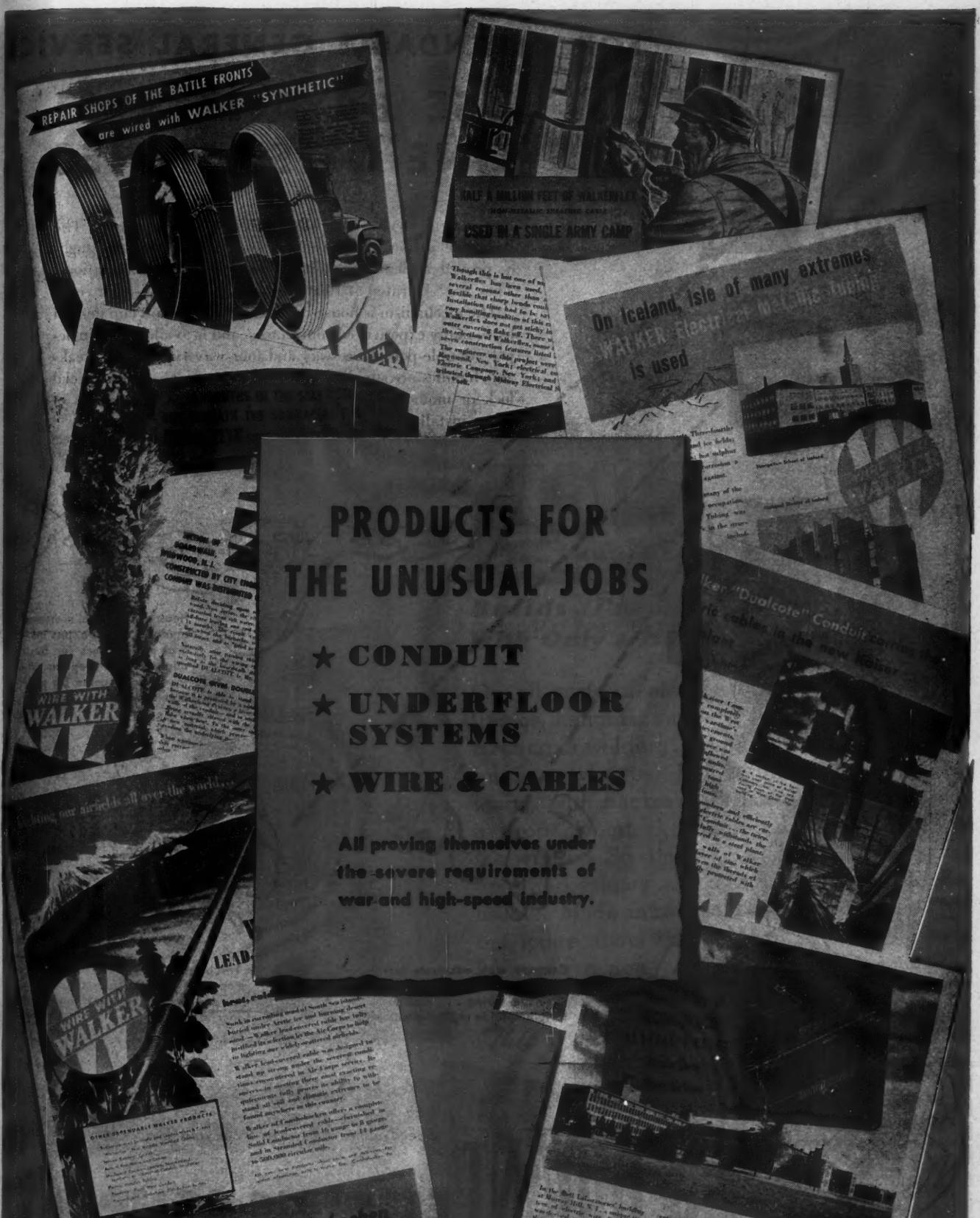
• BUSH HAMMERS

• WEB CUTTERS

• MORTAR CHISELS

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PORTABLE POWER
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PRODUCTS FOR THE UNUSUAL JOBS

★ CONDUIT ★ UNDERFLOOR SYSTEMS ★ WIRE & CABLES

All proving themselves under
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Wires in our routine usage of South Sea Islands
island under Army Air and Marine Corps
justified in action by the Air Corps to help
in fighting our newly-discovered islands.

Walker low-current cable is designed to
stand up in strong under-sea currents and
storms occurring in the 1000' range several
times during their stay. These must meet
the requirements fully to withstand the
severe extremes to which they are to be
subjected in these waters.

Walker of Conshohocken offers a unique
line of lead-covered cable—insulated in
Solid Cambric from 16 gauge to 8 gauge
and in Stranded Conductors from 12 gauge
to 500,000 circular miles.

All you have to do is to write for full details
on these products and we will be glad to
send you literature.

In the first industrialized building
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have its entire structure
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WALKER & Conshohocken

Makers of Rubber-covered, Synthetic and Lead-covered Wires and Cables. "Walkerflex" Non-metalllic Sheathed Cables. Service Entrance Cables. Automotive Wires and Cables. Shipboard Cables—Leaded, Non-Leaded; Synthetic or Varnished Cambric Insulation. Electrical Metallic Tubing. "Dualcore" Rigid Steel Conduit. "Preset-Insert" Underfloor Distribution Systems.

FOR DEPENDABLE GENERAL SERVICE

USE BRYANT 3951 LINE OF SWITCHES

For general service you want switches you can trust. The Bryant 3951 line of flush tumbler switches has been thoroughly proved under all conditions in millions of installations. They are "T" rated at 10 amps, 125 volts—5 amps, 250 volts.

The mechanism is housed in a shallow porcelain cup desired by so many experienced contractors, and is available in single-pole, double-pole, three-way and four-way types. Non-breakable handles are supplied in brown or ivory, as well as special lock or momentary contact types to meet the demands of every installation.

Heavy steel yoke, protected against corrosion, has integral plaster ears for flush alignment on irregular surfaces. Ears scored for easy break-off if not desired.

Contacts with adequate terminal screws arranged for easy top-wiring . . . particularly helpful in replacements.

Trouble-free, long life at rated capacity ("T" rated) is assured by quick-acting, arc-resisting mechanism.



Specify Bryant Devices from your Electrical Wholesaler

ELECTRIC COMPANY

BRIDGEPORT 2, CONNECTICUT



White porcelain shallow cup, enclosing the mechanism compactly, permits installation in shallow-type boxes. Reinforced at stress points to assure lasting durability.

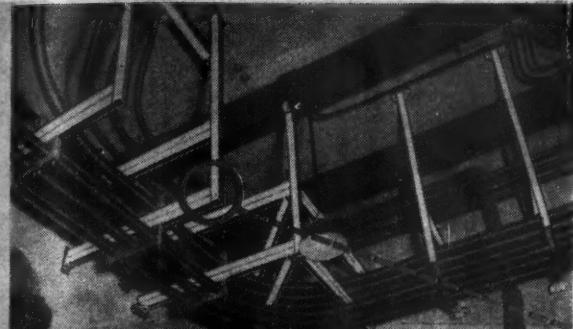
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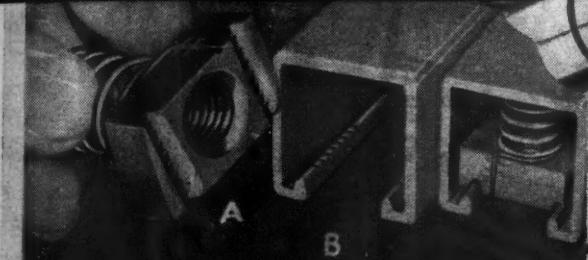
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A SUBSIDIARY OF WESTINGHOUSE ELECTRIC CORPORATION



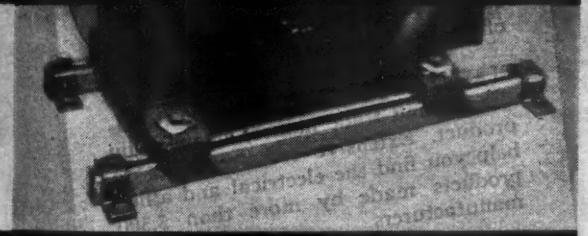
Need supports for cables or wiring . . . quick? Use UNISTRUT . . . makes 'em in a hurry!



UNISTRUT consists of (A) slotted hollow square steel member and (B) spring-held nut attachments with teeth which bite into the tured-in edges of hollow-square section and hold attachments in any desired position.



Need new stock racks . . . benches . . . machine supports . . . quickly? UNISTRUT is the answer!



Need motor bases in a hurry? Or supports for electrical instruments or equipment? You can have them, pronto, with UNISTRUT.

101 Uses in Electrical Industry

Cable and Conduit Supports . . . Bus bar supports, hangers, etc . . . Man-hole inserts, brackets, etc . . . Switch and panel board supports . . . Motor Starter and switch box supports . . . Motor bases, adjustable . . . Framing for large cabinets . . . Bus and switch cell structures . . . Power Duct System supports . . . Outdoor and indoor sub-stations . . . Disconnecting switch and barrier supports . . . Lighting system supports . . . Stud bolts . . . Beam clamps . . . Suspension Rods . . .

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Build Electrical Frames, Hangers, Supports! Without drilling, riveting or welding!



Builds 'Em Right On the Job . . . With Only a Hacksaw and a Wrench!

On all sorts of electrical jobs you can build frames, hangers, supports, without any drilling, riveting or welding . . . with UNISTRUT. Only three quick easy steps: 1. Cut UNISTRUT to desired length with hacksaw. 2. Locate fitting and nut at proper point. 3. Bolt securely with a turn of the wrench. So simple! So fast! UNISTRUT saves time and money . . . 100% Adjustable and Re-usable. Made in several sizes and gauges. Find out today about this shortcut in getting ready for reconversion!

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• Each issue of E-B-R is as up-to-date as the New Year itself. Every bit of data in the Directory Section has been checked and revised. In the manufacturers Briefalog* section, every bit of product information has been brought up-to-the-minute by the manufacturers themselves. E-B-R is the *only* annual product reference book published in, and for, the electrical industry.

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- You need to know who makes an unusual or infrequently used product.

E-B-R is your electrical reference, designed to help solve your specifying and requisitioning problems. Use it to save time and money.

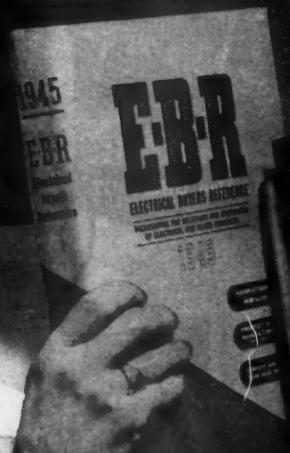
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McGRAW-HILL PUBLISHING COMPANY

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IF ITS ELECTRICAL
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Condensed catalogs of 357 manufacturers.
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CLASSIFIED DIRECTORY—Company addresses and trade names, arranged by product. Extensive cross-reference to help you find the electrical and allied products made by more than 3,500 manufacturers.

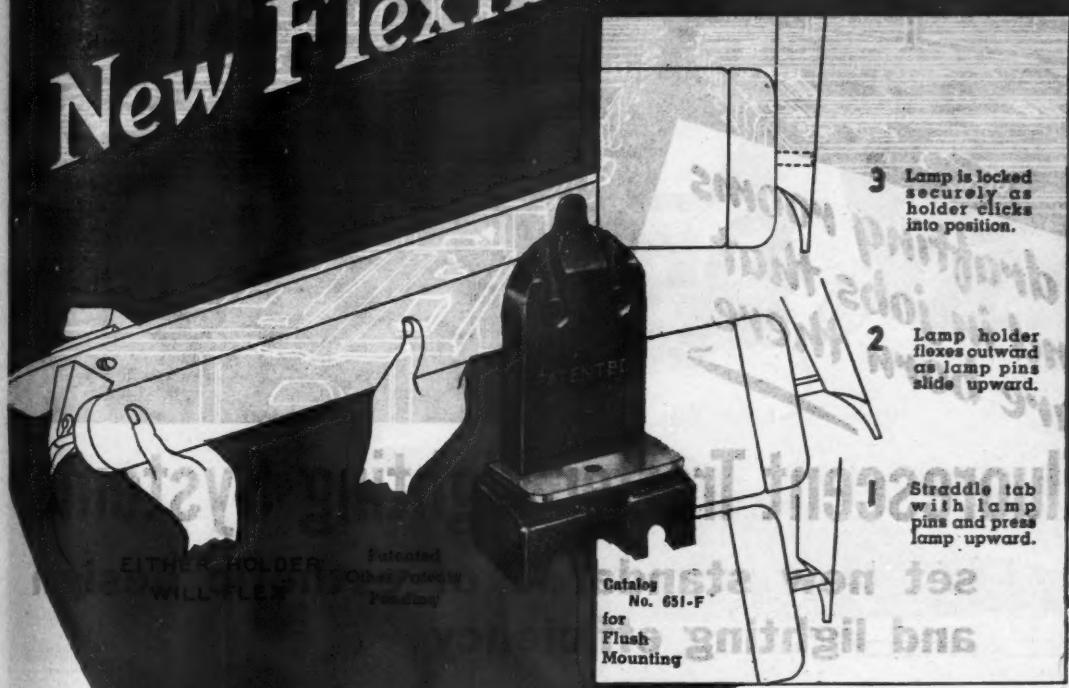
INDEX OF TRADE & COMPANY NAMES—
Complete with addresses. Starting with only a trade name or a company name, you can quickly locate the product data you need.

Please don't monopolize your copy of E-B-R.

Show it to other key men in your company, and let them use it, too. Under government paper restrictions, we can distribute only a limited number of copies. You will help us to help you by sharing your E-B-R.



Perfection - Plus Lloyd's New Flexible Lamp Holder



3 Lamp is locked securely as holder clicks into position.

2 Lamp holder flexes outward as lamp pins slide upward.

Straddle tab with lamp pins and press lamp upward.

No. 651-F—flush mounting
No. 651-S—surface mounting
No. 653-F—Combination
Lamp Holder and
Starter Socket for Flush
Mounting

All numbers furnished
in black or white

Check These 10 Points of FLEX-LOC SUPERIORITY

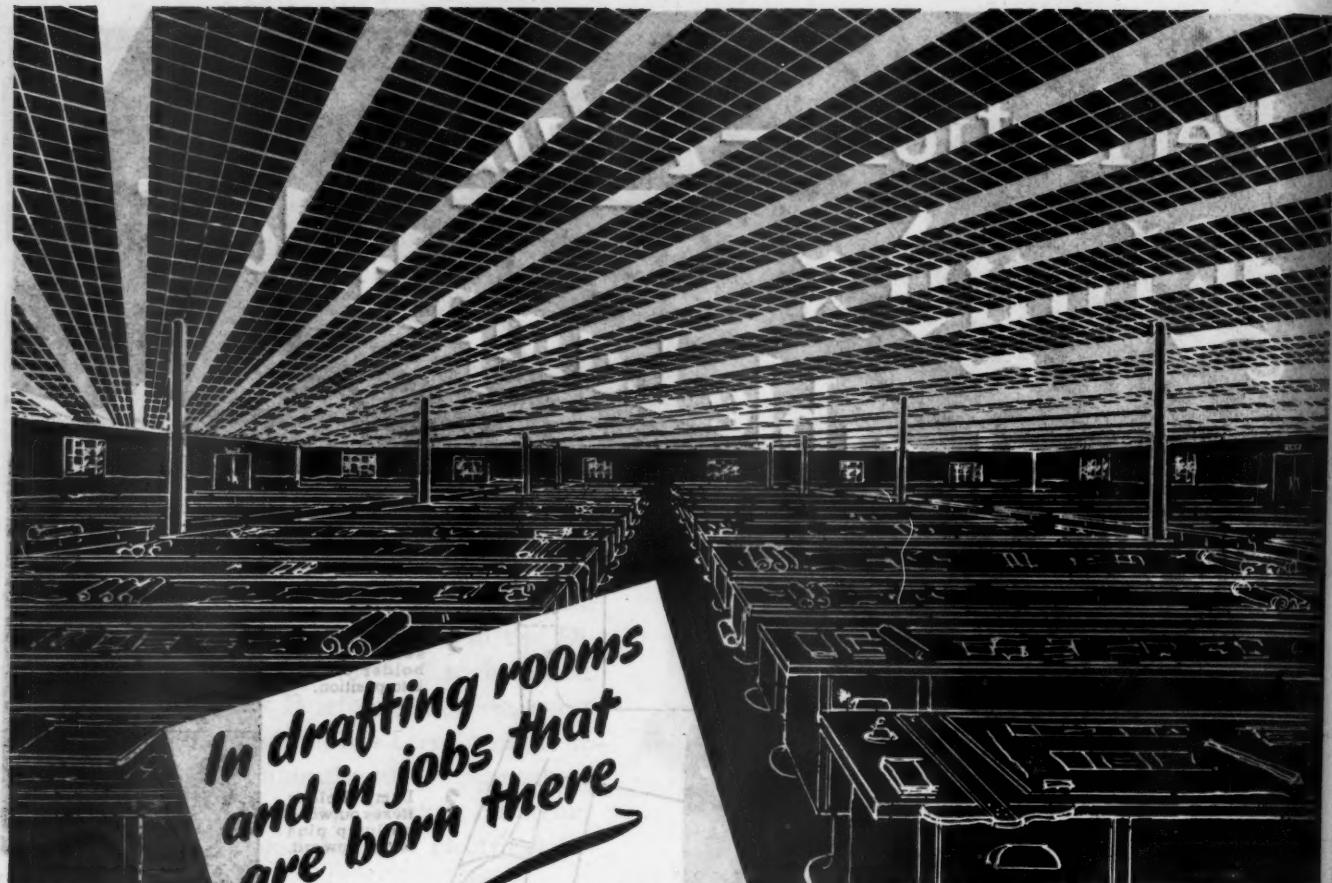
- 1 **FLEXIBLE**—automatically adjusting to variations in length of lamps and the spacing of mounting holes in reflector units.
- 2 **AUTOMATIC LOCK** is positive. No need for extra locking devices to protect lamp. Absolutely safe. Lamp positively cannot fall out. Holder stands all kinds of shocks and vibrations without loosening contact.
- 3 **SIMPLE** yet sure insertion and removal. No twisting. No turning. No fussing to seat lamp in the holder. FLEX-LOC Lamp Holder does the work automatically.
- 4 **PERFECT ELECTRICAL CONTACT** made absolutely sure and positive by newly designed patented contacts which grip BOTH sides of lamp pins.
- 5 **NEW STREAMLINE DESIGN**—Projecting "tab" on
- 6 **SIMPLIFIED MOUNTING**—Tapped hole in mounting bracket eliminates need for mounting nuts.
- 7 **ADAPTED TO ALL TYPES OF FIXTURES** (Counter lighting, continuous line lighting, in reflectors where limited space makes insertion and removal of lamps difficult.) With FLEX-LOC no turning or twisting of lamp is necessary.
- 8 **TESTED AND APPROVED** by testing laboratories. Withstands 2,000 foot pounds high impact shock tests.
- 9 **MOLDED** from strong-bodied plastic with high dielectric strength.
- 10 **NO NEED TO CHANGE** fixture layout. Engineered to fit all standard fixture spacings.

Lloyd Policy Insures Quality

LLOYD PRODUCTS COMPANY

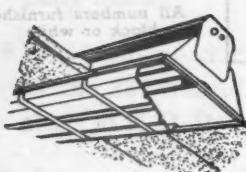
PROVIDENCE 5, R. I.

Representatives and Warehouses in 23 Leading Cities



Miller Fluorescent Troffer Lighting Systems

set new standards of esthetic design
and lighting efficiency



Other Pluses of MILLER Fluorescent Troffer Lighting Systems:

Supports from structural
ceiling reduced 50
to 75%.

Conduit and conduit
fitting costs reduced up
to 80%.

Wiring costs reduced
up to 50%.

Permanent operation
and maintenance econ-
omies.

You'll find Miller Fluorescent Troffer Lighting Systems in many drafting rooms. In these rooms, tomorrow's housing of commerce, industry, schools and public buildings is now being designed. Designed and *worked out* by the hard-boiled rules of practicability.

For Miller Fluorescent Troffer Lighting Systems lick lighting problems, planning problems and structural problems. So much so, that today's trend is to plan the *building* around the *lighting*!

Miller Fluorescent Troffer Lighting Systems, in geometric patterns and light-strips "by the mile", suggest new architectural themes. So does their versatile variety of glass and plastic lenses, plates,

and metal or plastic grilles...all designed to meet specific architectural and lighting requirements.

The Miller Patented Bracket is an example of Miller engineering. Instead of laboriously fitting recessed lighting systems into hung ceilings, this bracket is hung from the *structural* ceiling. Then, both furred ceiling and Troffer Lighting System are simply hung *from the bracket*!

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It has come to this— but we haven't cut Howell Quality

Yes, many of those good dependable Howell Motors have been shipped by air express to those who vitally need them for the war effort. The delivery situation in the entire electric motor industry is just this serious.

But we haven't cut Howell quality in any way. Prewar standards are being rigidly maintained without any compromise whatsoever in quality.

It's to your advantage to bear with us! We recognize our obligation fully and are putting forth our maximum efforts to build more and more motors, and to see that they are distributed among users whose needs are most vital.

HOWELL ELECTRIC MOTORS COMPANY

HOWELL, MICHIGAN

Manufacturers of Quality Motors Since 1915

The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined—utilizing non-breakable steel frame—malleable or steel base—cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available. Available in sizes 5 H.P. and smaller. Other sizes and types available up to 150 H.P.

On their Way again to Win again!



Are You?

Today the veterans of our European victories are sailing to final triumph in the Pacific! Meanwhile patriotic American industrial leaders are following a full-speed-ahead program to hasten peace through the Payroll Savings Plan!

From coast to coast, veteran Bond salesmen—and women—who put over the Mighty 7th; are once more mustered into service for plantwide selective re-

solicitation campaigns. These special efforts to keep employee Bond buying at a maximum are directed toward two major objectives:

- A** To hold every new 7th War Loan subscriber on the Payroll Savings Plan books—maintaining and, wherever possible, increasing present Bond allotments.
- B** To convince all regular sub-

scribers who recently stepped up their Bond buying, of the many advantages of continuing on this foresighted, extra Bonds-for-the-future basis.

Back up our fighting men who have won one war—and will win another. Use selective resolicitation to make your Payroll Savings Plan more effective—put a tighter rein on inflationary tendencies—build peacetime prosperity.

The Treasury Department acknowledges with appreciation the publication of this message by

ELECTRICAL CONTRACTING

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and War Advertising Council



Luminaires are aluminum High Bay reflectors with wide-spread distribution. To clear the cranes, they are mounted high above the assembly area, correctly spaced for uniform light distribution. 20 to 30 foot-candles are recommended for general assembly areas of this nature.

... get **BOTH** with *Westinghouse*
Lighting

GOOD lighting equipment alone can't produce good lighting. Back of the equipment itself, there must be accessible—to architect, contractor and user alike—practical knowledge of the many recent advances made in *application* of lighting equipment. You get **BOTH** with Westinghouse.

Not only does Westinghouse equipment incorporate the newest in design features, but where any out-of-the-ordinary application problems are involved, the breadth of Westinghouse experience is also available to insure its most effective use.

Westinghouse lighting equipment is available in a complete range of types and ratings for every commercial, industrial and floodlighting use. Write today for Bulletin No. B-3568—which describes the Westinghouse "Millite", a particularly versatile luminaire for heavy industrial use. And for help in selecting and applying the best equipment for your needs, call your Westinghouse distributor, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-04022



For critical seeing tasks, Westinghouse Focalaires supplement the general lighting and provide up to 300 foot-candles on the working surface.

Westinghouse LIGHTING EQUIPMENT

AVAILABLE THROUGH 127 WESTINGHOUSE ELECTRIC SUPPLY CO. OFFICES AND INDEPENDENT DISTRIBUTORS

SHITHIT LIKE THE RADIO



Electrical Raceways

How to Work with Manufacturers

WEIZINGER'S ELECTRIC SUPPLY CO., DEALERS AND DISTRIBUTORS
OF ALL KINDS OF ELECTRICAL EQUIPMENT
convenient time. On E. M. L. insta-
turn the pipe—every con-

STREAMLINED RACEWAYS OF



Simply spot the outlet and mount the box with necessary connectors already attached. Then run in the tubing at some later convenient time. On E. M. T. installations it is not necessary to turn the pipe—every connector is a union.

have gone modern, too!



OF REPUBLIC ELECTRUNITE E.M.T. RATE TOP RECEPTION WITH ARCHITECTS AND CONTRACTORS ALIKE

There are four excellent reasons why both architects and electrical contractors are enthusiastic about ELECTRUNITE E.M.T.—the modern streamlined raceway for wiring. Here they are:

ELECTRUNITE E.M.T. IS SAFE

Inspection by Underwriters' Laboratories and approval by The National Electrical Code for exposed, concealed or concrete slab construction is your assurance that ELECTRUNITE E.M.T. offers adequate mechanical and electrical protection at every point of the installation. Its tightly adherent zinc coating provides continuous rust and corrosion protection—unbroken by threads unmarred by vise or pipe wrench teeth.

ELECTRUNITE E.M.T. IS THREADLESS

Eliminates dirty, tedious thread cutting. A pair of pliers and two simple compression-type fittings create strong water-tight joints which will not work loose—even under vibration. Can be easily and quickly combined with ex-

isting threaded conduit installations and fittings, too.

ELECTRUNITE E.M.T. IS LIGHT IN WEIGHT

Because no excess metal is needed as a base for thread cutting, it actually weighs less than half as much as ordinary threaded conduit. Makes installation easier . . . and faster in installations where runs are in hard-to-reach locations.

ELECTRUNITE E.M.T. BENDS EASILY

With the patented one-piece ELECTRUNITE Bender, all types of predetermined bends may be made rapidly and accurately—in the shop or on the job. Your nearest Republic ELECTRUNITE Distributor will gladly give you full information on this up-to-date, rigid steel conduit. Write or wire us for his name and address.

REPUBLIC STEEL CORPORATION

STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO

Export Department: Chrysler Building, New York 17, New York



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LIGHT WEIGHT THREADLESS RIGID STEEL CONDUIT

FREIGHT RATES and INDUSTRY LOCATION

ASIGNIFICANT decision, announced by the Interstate Commerce Commission last May, will take preliminary effect on the 30th of August. It will eliminate some of the advantage in freight rates which Eastern shippers have enjoyed over shippers of the South and West.

The decision has been enthusiastically hailed as an Emancipation Proclamation for industrial development in the South and West. It has also been roundly condemned as a meddlesome control measure that ignores valid differences in haulage costs, and recklessly blots out one of the important factors in determining the location of American industry.

Cooler appraisals indicate that the net effect of the rate changes will be far less drastic than predicted by the more passionate advocates or adversaries. Nonetheless, it is important for the business world to be informed both upon the principle at issue, and upon the foreseeable consequences of the ICC ruling.

What The Decision Calls For

The Commission's order, unless modified, or successfully contested in the courts, will require: (1) the eventual establishment of a single freight classification, or grouping of commodities for rate-making purposes, for application throughout the United States; (2) a single level of "class rates"—or rates established for groups of commodities and primarily applying to manufactured and semi-manufactured articles of high value—in the area east of the Rocky Mountains. This level is to be about 15 per cent higher than the present Eastern scale.

Because it will take some time, probably several years, to work out a uniform classification in place of the three major classifications now existing, a preliminary adjustment is provided.

Under this adjustment the existing classifications will remain in effect, but the rates on articles moving on *class rates* will be increased 10 per cent in Eastern or Official Territory—the area east of Lake Michigan and the Mississippi River and north of the Ohio River. On the other hand, the rates will be reduced 10 per cent on articles moving on class

rates in the South and West, and on those moving interterritorially.

What The Problem Was

At the present time there are marked differences in the levels of the basic scales of class rates in the five major rate territories—Eastern or Official, Southern, Western Trunk-Line, Southwestern, and Mountain-Pacific. It is difficult to average the levels of rates, but if the level of the class-rate scale in Official Territory is taken as 100, the levels in the other territories may be roughly considered as follows: Southern, 139; Western Trunk-Line, 128, 146, 161, 184 in Zones I, II, III, and IV, respectively; Southwestern, 161; Mountain-Pacific, 166.

These are over-all comparisons. On many individual articles the differences in levels of rates are greater or less than indicated because of offsetting differences in regional classification schemes. In many cases, the use of exceptions to the classifications and of special commodity rates has reduced the regional disparity in rates. In fact, on some articles, particularly on certain low-grade traffic such as logs, pulpwood, bricks, coal, sand and gravel, the South and the West have actually had lower rates than Official Territory. The rate disadvantage of the South and West has been principally on manufactured articles.

The territorial differences in class-rate levels have complicated the problem of constructing rates from a point in one territory to a point in another. Today, such a rate tends to represent a blend of the levels in effect at the place of shipment and at the destination. Thus manufacturers and dealers in a higher-rated territory are likely to see themselves at a disadvantage when they attempt to sell goods in a lower-rated territory against competition located there.

Now, if differences between territorial rate levels are removed, the interterritorial freight-rate problem largely disappears. So it is an important question whether such differences are justified. The Commission has found that they are *not* justified either by differences in transportation costs or by

other valid considerations. From that finding came the order to establish a uniform level of class rates and a single freight classification.

The Decision And The Map Of Industry

What effect will this decision have on the location of industry in the United States; and what effect will it have on the economic development of the East, the South, and the West?

Today, many in the West and South believe that their higher class rates have seriously retarded the industrial development of these areas, and promoted the concentration of manufacturing in Official Territory. They point out that Official Territory has over 50 per cent of the population of the country, had nearly 70 per cent of the persons employed in manufacturing in 1940, and accounted for nearly 73 per cent of the "value added by manufacture" in 1939. Boasts of industrial development in the South, and to some extent in the West, in recent years are accompanied by claims that this would have been greater but for the freight rate structure.

Another point gets into the argument. Official Territory is not only the country's most highly industrialized section, but also its greatest consuming territory. It is the market which nearly all manufacturers desire to reach, particularly when they have a surplus to sell. Here again is occasion for an outcry by producers outside of Official Territory against the consequences of their high rate levels and the levels of interterritorial rates. Under the circumstances it is not strange that the South and West have argued long and volubly for mile-for-mile equality in rates.

Those in Official Territory deny that the South and West have been handicapped by the rate adjustment, but at the same time look with apprehension at the loss of their rate advantage.

What's The Effect?

However, now that the ICC's ruling is about to be put in operation, it is time for the colorful statements of the debating period to give way to a sober appraisal of what the consequences are likely to be.

In the first place, it should be noted that the preliminary adjustment will affect only a small fraction of the traffic. Estimates indicate that only about 4 per cent of the full-carload traffic moves on regular class rates. About 11 per cent moves on exception ratings which are not affected by the preliminary order; and about 85 per cent moves on commodity rates, which were not within the scope of the Commission's decision. The proportion of less-than-carload lot traffic affected is much greater, since a large

part of it moves on class rates; however, less-than-carload traffic constitutes less than 1½ per cent of the total tons carried.

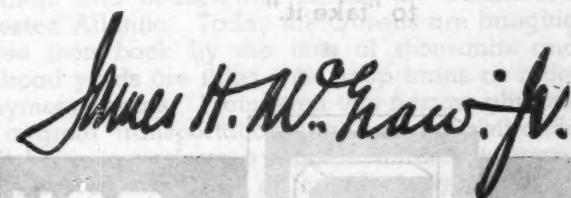
The permanent rate structure will probably affect more traffic than the preliminary order since, in the establishment of a uniform classification containing more classes than at present provided, many articles now moving on exception ratings are likely to be brought within the scope of the classification, and the same may be true of some articles moving on commodity rates.

But, even if a large proportion of the traffic were affected by the Commission's order, or if the principle of equality in rate levels is eventually extended to much of the traffic moving on commodity rates, these freight-rate adjustments cannot be expected to revolutionize the pattern of industrial location in the United States.

It seems evident that most industries now found in Official Territory are located there for other advantages than that of a lower level of freight rates, undeniable as such an advantage is. Insofar as that is the case, they have little to fear from equalization of the rate levels. For those which have, indeed, been dependent upon preferential rates and otherwise badly located, the removal of the preference and their consequent shift to some area possessing a real locational advantage would be desirable from the point of view of the national economy.

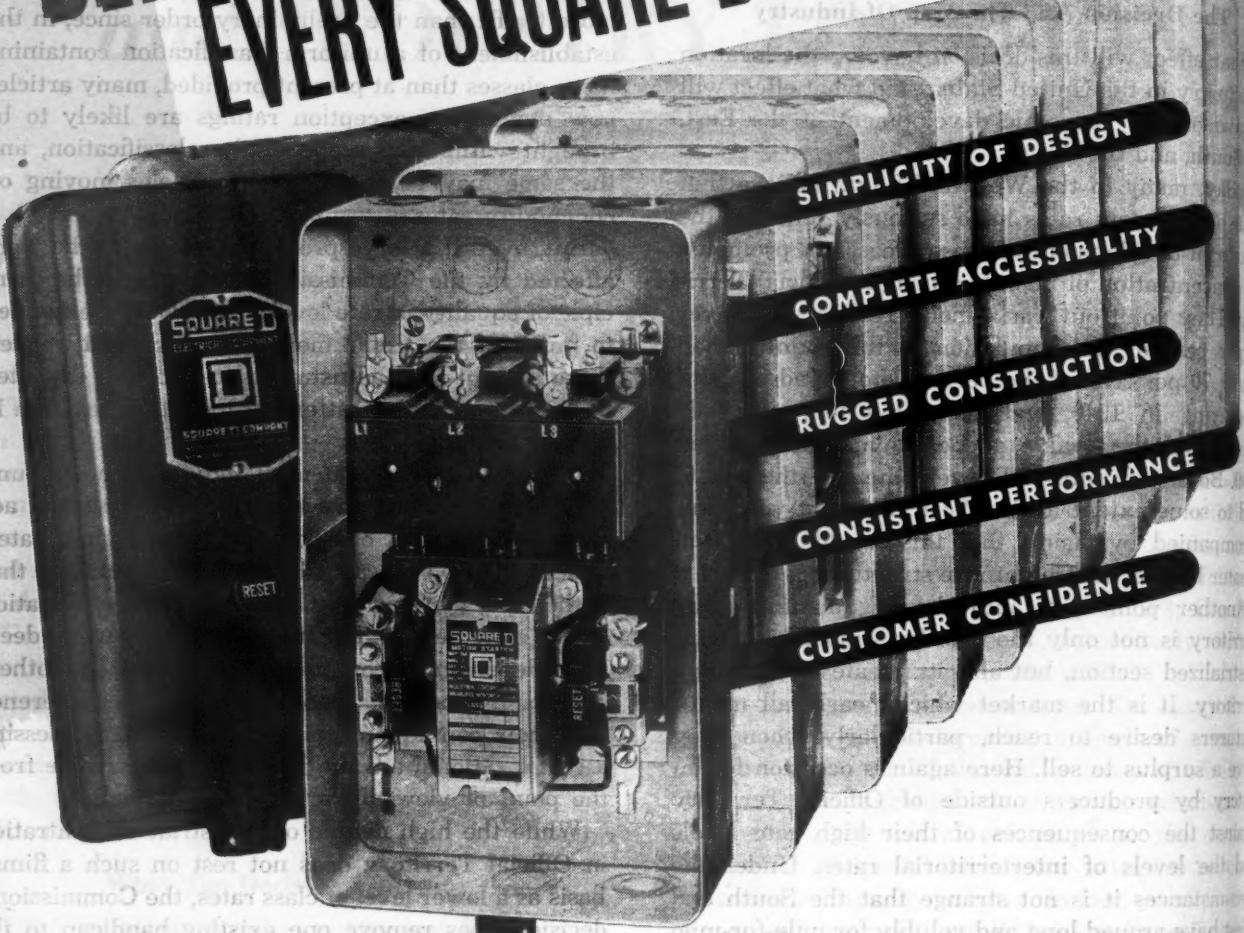
While the high degree of industrial concentration in Official Territory does not rest on such a flimsy basis as a lower level of class rates, the Commission's decision does remove one existing handicap to the growth and development of the South and West. The new adjustment should permit all sections of the country to develop the industries for which they have natural advantages. It should contribute to a sounder regional specialization than we have heretofore had.

This decision will neither destroy the economy of the industrial East, nor will it, overnight, assure the industrial flowering of the South and West. It constitutes one sound step toward establishing that equality of opportunity for all sections of the country which is essential to a nation that bears the proud title of *The United States*.



President, McGraw-Hill Publishing Co., Inc.

BEHIND EVERY SQUARE D STARTER

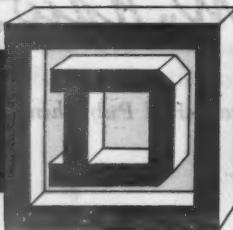


You can change magnet coils, contacts or overload relays in no time at all—and without disturbing external connections. Square D is designed for simplicity.

You have plenty of wiring space and easy-to-get-at terminals. Installation and inspection is faster and easier. Square D is designed for accessibility.

You can be sure that any starter from Square D's unusually complete line will deliver the kind of service which builds customer confidence and good will.

Their performance in thousands of plants proves that Square D starters are built to "take it."



SQUARE D COMPANY

DETROIT

MILWAUKEE

LOS ANGELES

Write for Bulletin 8536
Square D Company, Industrial Controller Division,
4041 North Richards St., Milwaukee 12, Wis.

AUGUST . . . at a Glance

Among the distinguished visitors to our editorial offices this month was Frank Boyd of the Pacific Electric Motor Company in Oakland. The story on their operations and the rebuilding and maintenance of Navy equipment should be one of the great motor shop stories of the war. We hope to have it for you as soon as military security permits it to be told.

Electrical construction needs good men. Returning veterans will provide a pool of the best. One way we can assure ourselves of the right kind of man with the right attitude is to give him a clear picture of the opportunities in the field. In "G-I Jobs", page 59, this month you will find a compact story that you can pass along to the veterans who come to you for advice and counsel.

Grounding is one of those common practices in electrical work we all take pretty much for granted. The how and why of grounding is, however, a complete and important subject that should be thoroughly understood. A. H. Schirmer, who is the Chairman of Article 250 Committee and protection standards engineer of Bell Telephone Laboratories, has prepared one of the clearest and most objective explanations of the over-all problem and techniques that we have yet encountered. You will find this article on page 62.

A vital element in the health and well-being of our men in the Pacific area is the elaborate machinery which brings fresh foods directly to the fighting fronts. And the keystone is the refrigerated barge. The wiring and electrical equipment for many of these refrigerated barges was handled by a California contractor who was commissioned by the Army to speed the work. Bill Cyr, Pacific Coast Editor, has prepared the interesting story of this little-known phase of our industry's part in the Pacific War. See "Wiring Refrigerated Barges," page 69.

Lighting in our postwar homes promises a whole new era in electrical living. The accumulated techniques of ten years of fluorescent lighting development have yet to find their way into

places where people live. There's big money and a big responsibility in the residential lighting market. Intelligently planned and promoted, we have a chance to make a great contribution to better living and Berlon Cooper's article this month on residential lighting techniques is squarely on the beam. Here are up to date ideas for home lighting. The article is on page 72.

Bruce Thompson, as lighting engineer for R G & E at Rochester, New York, works closely with local contractors in developing modernization jobs. He describes one handled by the T. H. Green Electric Company at the E. P. Reed Shoe Company. It is a splendid example of the market opportunities in lighting and wiring modernization that are all around us today. You will find the story on page 76.

Albert Kahn's Chief Electrical Engineer, V. C. Wagner, takes a look into the immediate future of wiring methods and installations in his provocative article on page 78. As a top engineer with one of America's greatest industrial architects, his predictions are founded on a thorough-going knowledge of wartime wiring development.

In our May issue, Lou Kummel gave us the know-how on wiring cellular steel floors. To back this up with more useful data, he has collected a substantial body of unit labor cost figures applying to the many specialized wiring devices used in this kind of construction. Look for this timely article next month.

Just over our left shoulder are the great piers where the tremendous gray Queens once loaded soldiers and headed out across the submarine-infested Atlantic. Today the Queens are bringing these men back by the tens of thousands and railroad yards are filled with troop trains as redeployment begins. From even this narrow glimpse of a great transportation problem, the railroads will have to perform a modern miracle to carry out the program. Let's all help by staying off the railroads, excepting on the most urgent business.

Because of the basic importance of adequate wiring to the entire electrical industry, Anaconda is presenting messages like this in a wide list of national publications.



yet inadequate electrical wiring can rob
appliances of that much performance—

...In postwar planning,

YOU MAY spend a good deal on future electrical comforts—a new refrigerator and range, de luxe laundry equipment, advanced heating, perhaps air conditioning, and a host of appliances.

Don't undermine this investment. Realize that out-of-date electrical wiring in the house can cut equipment performance twenty-five to fifty percent!

If you anticipate an increased elec-

trical load on your wiring, make sure to have enough circuits, service devices and outlets. In other words, check up on your postwar wiring plans now and avoid expensive changes later.

Business executives! Don't neglect your postwar wiring plans. It costs nothing to check them now, but it may cost plenty later for shutdowns, alterations. Talk it over with your consulting or plant power engineer, electrical con-

tractor or power salesman. They'll agree that it's always wiser to Wire Ahead! Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company. General Offices: 25 Broadway, New York City 4. Chicago Office: 20 North Wacker Drive 6. Sales Offices in Principal Cities.

✓ *Check your wiring plans before they check you!*

HELP BRING VICTORY SOONER
... BUY MORE WAR BONDS



ANACONDA WIRE & CABLE COMPANY

WHY DOES GRAYARD

CONSTRUCTION NEEDS A GREEN LIGHT

L-41, the order which controls the vast construction industry, is one of the few major limitation orders still on the books in Washington. Review and specific authorization is still necessary for construction projects of any substantial size. There has been some relaxation. Small projects can go ahead if materials are available. The value permissible without authorization will undoubtedly be raised in the coming months.

There are many good reasons for a restraining hand on the industry during "Period One." There is a critical shortage of lumber, for instance, and manpower and manufacturing facilities as well as a host of essential components. And a good many contractors with their facilities all tied up in war construction are none too anxious to see the controls removed right now.

The proper test of limitations today, however, is not whether there are good reasons for keeping them, but whether the war effort would be seriously impeded if they were dropped. No matter how "good," or popular, or desirable or logical the rules may be, they should not be held to control operations which do not affect the manning and equipping of the Pacific War.

L-41 can be dropped today without a ripple in the war effort. Materials for the armed services will go

ahead on schedule. Vital war construction, of which there is comparatively little left, will still rate the highest priority. The net result would be a release of the available materials and manpower into regular commercial channels without overall control.

There is a curious philosophy current, and not only in Washington, that sudden relaxation of regulations before unlimited supplies are available will result in chaos. Some reluctance on the part of manufacturers and distributors to assume the responsibility for equitable distribution of scarce materials is understandable. But a smart sales department with its economic future at stake is quite likely to do as fair and competent a job as any government agency.

Though the elimination of L-41 would not add a foot of lumber nor a man hour of labor to our short supply, it would give the green light to plans and specifications. It would stimulate preliminary sales work and engineering. And these vital activities must begin now if we expect to provide construction jobs in '46 and '47.

Wm. F. Stuart

Electrical Contracting

AUGUST, 1945

They'll
to Wire
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Copper
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Chicago
6. Sales

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ANY

st 1945

WHY DOES GRAYBAR TELL JOHN WATTS' STORY?

which
ARE O.K. IN KOKOMO?



LOOK TO

John Watts
Electrical Contractor

FOR THE "LOW-DOWN" ON LOCAL CODES

INTRODUCTION of new types and varieties of wiring supplies places more importance than ever on the interpretation of local electrical codes and building ordinances. What does "raceway" mean in Kokomo or Newark or Yuma, for example, when available raceways may be metal or plastic, rigid or flexible, round or rectangular?

When you're faced with electrical details like these, particularly on out-of-town jobs, you can count on "John Watts" — a qualified electrical contractor — to be familiar with the meaning of local codes as applied in practice. Look up the local "John Watts" early, while plans are still in the formative stage. You'll find that his knowledge of regulations and working conditions will speed planning and avoid time-consuming delays after construction has begun.

Also you'll find "John Watts" a reliable, up-to-the-minute source of the latest product in-

formation. His organization is ready with the most modern tools and installation "know-how" for wiring, lighting, signaling, electric drives, and drive controls.

You can count on the newest and best in everything electrical when you call on "John Watts", for well-informed contractors everywhere get their electric equipment and supplies via Graybar. Graybar Electric Company, Graybar Building, New York 17, N. Y.



The advertisement reproduced above appears in *The Architectural Forum*, August.

Graybar believes that building leaders can profit by taking fuller advantage of the specialized knowledge possessed by "John Watts", the qualified electrical contractor. That's why, for two years now, we have been running full-page advertisements about "John Watts" in *The Architectural Forum*. These advertisements are timely today, because they help builders realize how much the electrical contractor can do during the "transition" period to help make planning easier and construction smoother. The nearby Graybar Man is ready to help you to serve your customers with first-quality electrical supplies and last-minute product information. 4569

Veterans returning to their old jobs in the electrical construction industry will find their way eased by well organized planning. But what of the vast majority who must find their way to new jobs? They went into the war from school and college or from the casual work of youngsters yet to settle down.

Today these boys are mature, earnest, ambitious. They have acquired specialized skills. Some, with experience in the vast array of electrical apparatus used in modern warfare, look to electrical construction, installation and maintenance. What jobs are there? Where can we fit in? How do we get started? They have asked these questions of you and us. Here are some of the answers methodically outlined. A moderate number of reprints of this article are available for your friends in the armed services.

Dear JOE:

So you've decided to head toward electrical construction. Swell! You've picked a great game. It's on the upgrade. There's plenty of room for new blood and new brains. And that's where you come in.

What are the prospects for a good man looking for a job? They look pretty ample from where we are. There is a substantial upswing in construction coming as soon as materials are loosened up. There are vast areas for rewiring and relighting we haven't started to touch yet. And all that means jobs.

If you are one of the 25 percent or so returning veterans going back to your old job, the chances are you know your way. And you will find plenty of help along the way. If you are one of those who has yet to carve out his economic destiny, there is help on the way through local service organizations, contractors' associations, labor unions and electrical leagues.

In the following outline you will find a quick picture of the kind of jobs there are in electrical construction. It is not complete in detail. Individual concerns have specialized job categories and classifications in great variety. However, those listed are the regular jobs you will find in most communities. Like any other game, you will have to start in the lower ranks. Where you go from there is up to you.

G-I JOBS

What are the job opportunities in electrical construction for the returning veteran? There are plenty of big jobs for good men. Here is a quick outline to help him set his course.

By W. T. Stuart



Apprentice

To become an electrician, it is necessary to serve a period of apprenticeship. The term is usually four years. During that time the apprentice works on the job with experienced mechanics. In most large cities he also attends school for several hours each week. His scale of wages starts low, and increases each year until he reaches journeyman status.

Apprenticeship is the usual starting job in electrical construction. In those communities where apprenticeship plans are well organized, it gives the new man a wide range of training. He works on all kinds of projects while his schooling develops his understanding of the work around him.



Other Starting Jobs

In some cities there are jobs for electricians' helpers, a semi-skilled classification outside of formal appren-



ticanship. It is a type of classification which is disappearing, however. If such jobs are open in your community, they make an excellent entry into the game and a good vantage point for finding the kind of work you want.

Stock room clerks fill orders for materials and route them to the jobs. It is a good spot to develop a sound knowledge of materials, job routines, and general knowhow.

Draftsmen and cost clerks work with estimators and engineers developing plans, pricing estimates and handling much of the office routine. They are excellent starting points if you have your eye on one of these major careers. Timekeeper on larger projects is also a good starting point if you are looking toward supervisory work.

J Journeyman

The journeyman electrician has been called the aristocrat of labor. There are few, if any, of the mechanical crafts which call for a higher order of technical knowledge behind the manual skills required. He handles, prepares and installs a great variety of materials and apparatus. Some of the work involves hard manual labor. It is all exacting.



The range of skills included in the broad classification of electrician tends to develop specialization. A thorough apprenticeship gives the mechanic competence in any type of work he is likely to encounter. Personal preferences, however, usually lead the individual to specialized abilities in particular work. Some examples are trouble-shooting, control wiring, fixture installation, heavy pipe work or telephone installation.

In ordinary times, the journeyman moves between jobs as labor requirements dictate. He may work for several employers during the year. With experience, unusual ability or a useful specialty, he becomes a key man in one contractor's organization. When big jobs come along he may be upgraded to crew leader or foreman.

Background for a journeyman is a sound and well organized apprenticeship.



ship. Trade or technical school training is highly desirable particularly if you want to use the experience for stepping up to management jobs.

The electrician is usually a pretty substantial citizen. There are comparatively few itinerant workers in the craft. And the high level of technical knowledge required tends to attract men who are well above the average in intelligence and general stability.

Office Manager

Electrical construction is a business. It involves the same pattern of business routine, bookkeeping, accounting, buying, selling, billing and so on, as any other commercial enterprise. This work is usually headed up by an office manager, chief clerk or buyer.

Typical Jobs in Electrical Construction

General Manager	Bookkeeper
Engineer	Cost Clerk
Superintendent	Stock Clerk
Estimator	Stenographer
Buyer	Draftsman
Chief Clerk	Apprentice
Asst. Engineer	Helper
Asst. Estimator	J Journeyman
Asst. Superintendent	Foreman
Paymaster	Laborer
Clerk	Truckman
Timekeeper	Truck Helper

The office manager is first of all a good business man. He places the orders for materials. He interviews salesmen. He is responsible for the bookkeeping and accounting, billing and collections and the general clerical functions connected with business operation.

Technical qualifications are desirable but not essential. The office manager should have a good background of general business training. He often gets his start as a clerk or bookkeeper.

Engineer

The engineer's job in electrical construction is one of the most varied and interesting of all. He consults with owners and architects during preliminary planning. He makes wiring system layouts. He works out the details of apparatus selection and installation. He meets the customer as an expert. He combines a high order of profes-



sional ability and integrity with good commercial sense. He is a good salesman as well.

The role of engineer in electrical construction is one of growing importance. As wiring systems become more elaborate, as utilization expands and as apparatus grows more varied and complex, the engineer finds wider responsibilities and opportunities. It

is a career job and one that takes energy and ability.

The engineer should have a degree in electrical engineering from an accredited school. He usually starts by way of the drafting board, as an assistant engineer or assistant estimator.

Estimator

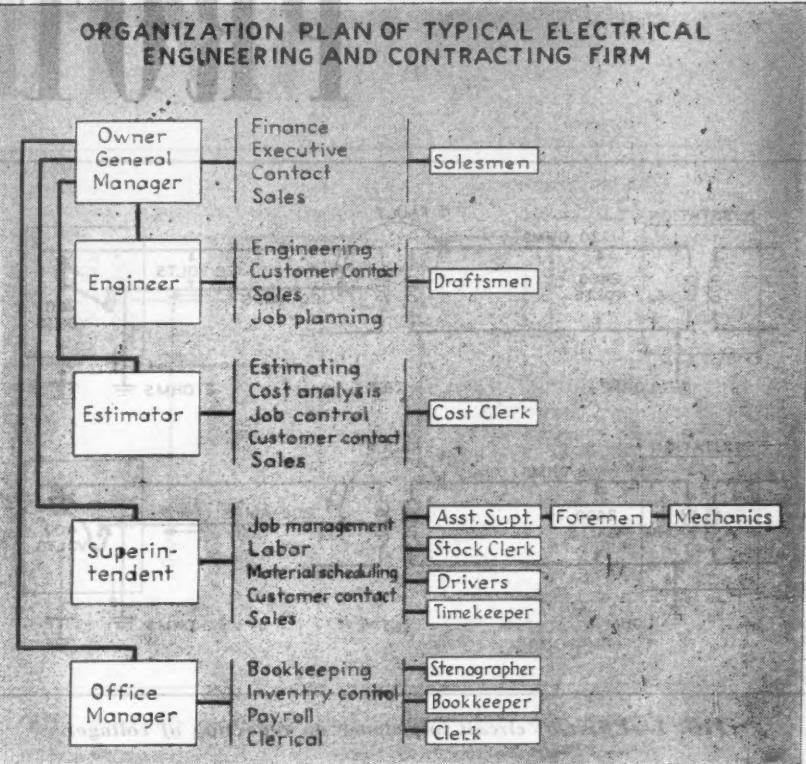
Construction jobs are usually let on the basis of bidding. The bidding may be competitive lump sum or a variety of other methods. From the initial preliminary study of the plans through the proposal and the actual work, it is necessary to develop cost estimates of considerable accuracy. This is the estimator's responsibility.

The estimator is a man of sound practical experience combined with a high order of technical knowledge. From this background, he develops a specific skill in analyzing plans and specifications and predicting job costs therefrom.

The estimator works up average labor units from actual job costs. He "takes off" essential data from plans and specifications and prices them from an orderly tabulation of unit costs. He is in close touch with materials and material costs. With the superintendent, he follows the trends in labor costs for both bidding and job control. He works with the engineer on layout, with the buyer on ordering materials, with the superintendent on labor schedules. He contacts the customer and prepares bids and proposals.

Estimating is a substantial job. It makes a fine career for the man who likes detail, figures and a high order of responsibility.

Estimators usually start from the ranks as electricians. Sometimes they come up from the drafting board or the job office. A good technical education is desirable. Sound experience and "know-how" is essential.



Superintendent

The actual performance of the electrical construction job is directed by the superintendent. He hires and lays off the men. He schedules the work to fit manpower and material supplies and the work of other trades. He is the liaison man with the architect's representative on the job. He is the man responsible for the execution of the contract.

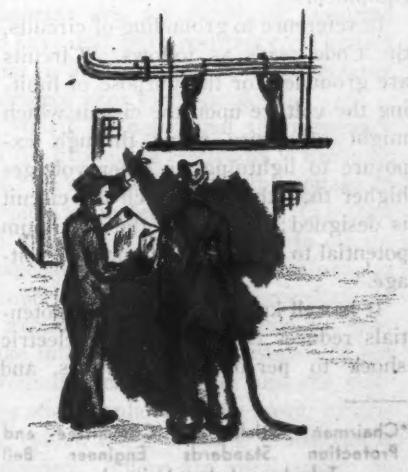
The superintendent is a man of wide practical experience. He is skillful in selecting and handling men. He has a thorough knowledge of electrical construction methods and works closely with the estimator and engineer.

He is a good salesman and in frequent touch with the customer. He is a skillful diplomat and cooperates smoothly with other trades.

The superintendent usually comes up from the ranks as an apprentice, journeyman and foreman. In rare instances he works up from the "overhead." He is a man among men, active in industry affairs such as labor-management committees and is a substantial citizen in his community.

ties. But the answer is beyond the scope of this article. If you have the necessary business acumen, practical and technical experience, financial backing and love of hard work, you can make the grade. If you can't work yourself up in a going concern as a responsible employee, however, the chances are all against success on your own.

The electrical construction industry has a high destiny. It is a game to tie to. There is constant challenge and opportunity. There is plenty of room for new blood and new ideas, for imagination and energy. For a good man it's a good life. I think you will like it, Joe.



You Want to be Boss

What about your own business? Yes. There are excellent opportuni-

PROTECTIVE

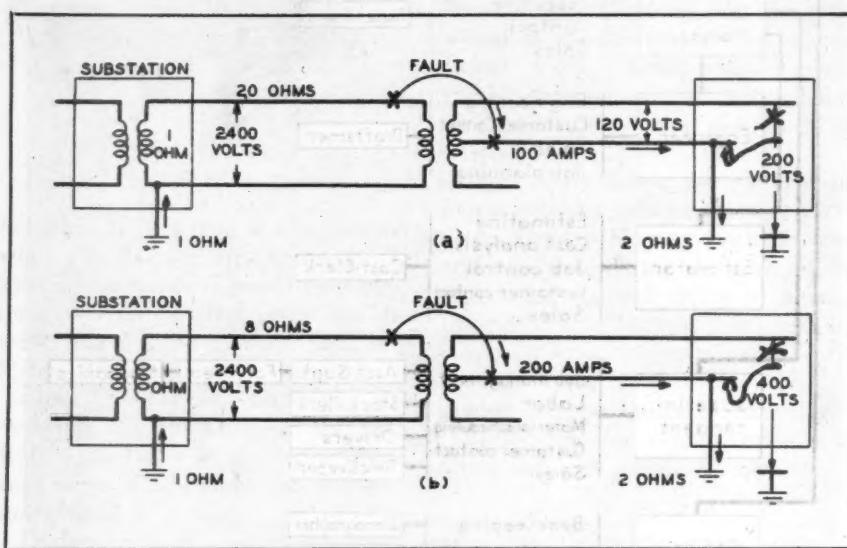


FIG. 1—Effect of circuit impedance on reduction of voltage.

PROTECTION of electric installations by grounding is a well established practice and has been required by the National Electrical Code for many years.

However, there is some confusion as to what constitutes effective grounding. Also recent discussions and suggested practices in connection with grounding have indicated that some of the fundamentals involved are not well understood.

The Code tells us why and what to ground. It states: "Exposed conductive materials enclosing electric conductors or equipment, or forming a part of such equipment, are grounded for the purpose of preventing a potential above ground on the enclosures or equipment."

In reference to grounding of circuits, the Code reads as follows: "Circuits are grounded for the purpose of limiting the voltage upon the circuit which might otherwise occur through exposure to lightning or other voltages higher than that for which the circuit is designed; or to limit the maximum potential to ground due to normal voltage."

It is well known that limiting potentials reduces the likelihood of electric shock to persons and animals, and

much emphasis has been placed on this point. What is not so well known is that limiting or preventing potentials by grounding reduces the possibility of arcing and insulation failure, and thus also reduces the fire hazard. In developing sound grounding practices, both the shock and fire hazard must be kept in mind.

Voltage Involved

There are ordinarily three sources of voltages for which protection must be provided: (1) Primary distribution

How and why grounding protects wiring systems and equipment.

voltages, 2400 volts and above; (2) voltages produced by lightning discharges; and (3) secondary distribution voltages, that is 120-240 volt circuits. Each of these sources will be considered separately. However, before doing so, it will be helpful to discuss a number of other factors.

Grounding Electrodes

It is evident, of course, that a grounding electrode should have a resistance as low as it is practicable to obtain. For this reason, the National Electrical Code provides that "a continuous metallic underground water piping system" shall be used as the grounding electrode where such piping system is available at the building served. Where water pipes or other extensive buried structures are not available, it is generally necessary to use driven rods or pipes as grounding electrodes. Except in limited areas where the soil is highly conductive,

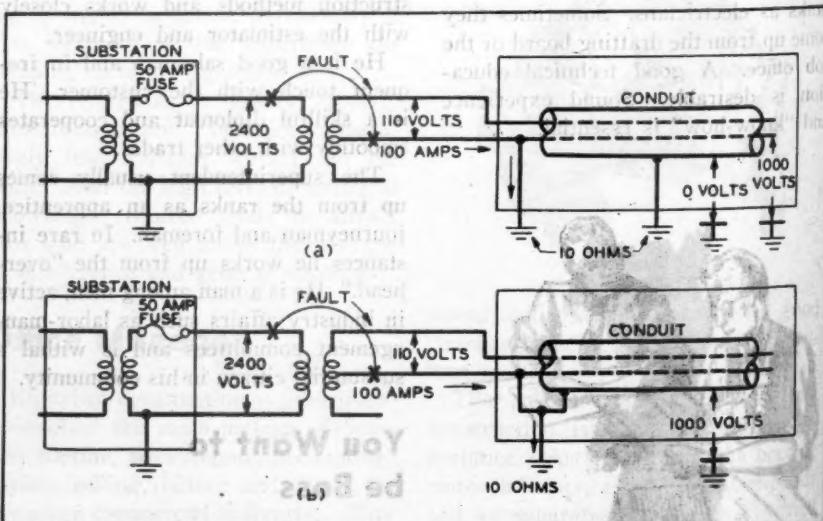


FIG. 2—Voltage to ground due to fault with primary circuit

*Chairman Article 250 Committee and Protection Standards Engineer Telephone Laboratories, Inc.

GROUNDING

By A. H. Schirmer*

it is not likely that driven rod or pipe electrodes having a resistance less than 10 ohms will be obtained. In many situations, the resistance of the grounding electrode will be materially greater. It is not practicable to require a specific value, since the cost of making a grounding electrode having a resistance of less than a given value varies greatly in different areas. In some locations, 10 ohms can be obtained with a single ground rod. In other situations, it may cost several hundred dollars to get a 10-ohm ground. It is in recognition of this fact that the Code does not require specific values of resistances for grounding electrodes.

Ground Potential

Since all grounding electrodes have resistance to ground, it is evident that an electrode which carries current will have a potential with respect to some other electrode which does not carry current, the magnitude of the potential depending on the resistance

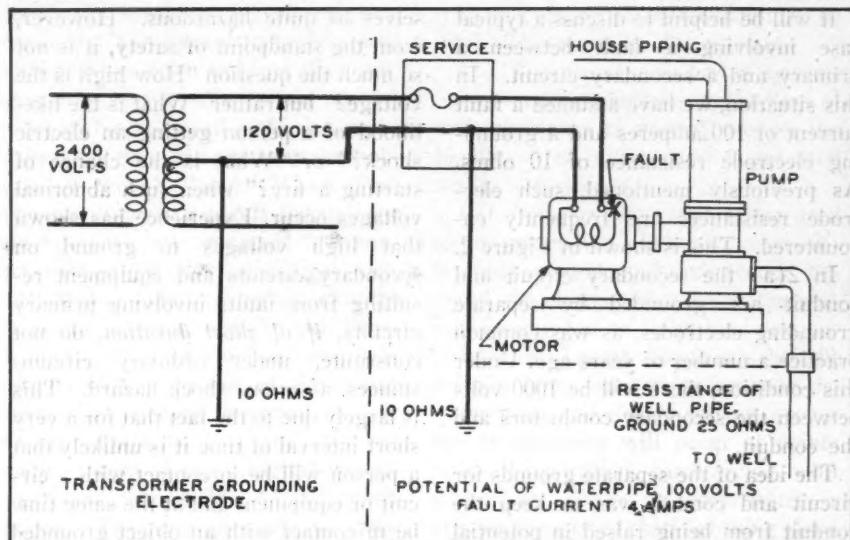


FIG. 4—Fault conditions with unbonded private water system.

of the electrode to ground and the magnitude of the current. For example, a fault current of 10 amperes through an electrode having a resistance of 10 ohms, would raise the voltage of the electrode and any metallic equipment or circuits connected to it to 100 volts.

Primary Distribution Voltages

If the secondary distribution circuit is not grounded and there is an accidental contact between primary and secondary conductors or a failure in the transformer, the potential to ground of the secondary system will be

raised to the voltage of the primary circuit (2400 to 7000 volts). The high voltage may remain for an indefinite period, assuming no insulation failure or accidental ground, since there will be no appreciable fault current. Such a high voltage not only constitutes a serious shock hazard but also frequently causes insulation failure. The resulting arcing may be quite severe and constitute a fire hazard. Grounding secondary circuits will reduce the voltage to ground as a result of a fault with the primary circuit. The extent to which it is lowered depends not only on the resistance of the grounding electrode but also on the primary circuit impedance. This is illustrated in Figure 1. In these diagrams, as well as in subsequent diagrams, the circuit elements are, for simplicity, assumed to have only pure resistance. The fact that in practice there is also reactance does not alter the conclusions.

It will be noted that the resistance of the grounding electrodes is the same in 1 (a) and 1 (b); yet the voltage to ground is materially less in (a) than in (b) due to the difference in circuit impedance. In order therefore to properly evaluate the effectiveness of a grounding system, we must not only take into account the resistance of the grounding electrode but also the voltage and impedance of the power circuit for which the grounding protection is provided. There are rural situations

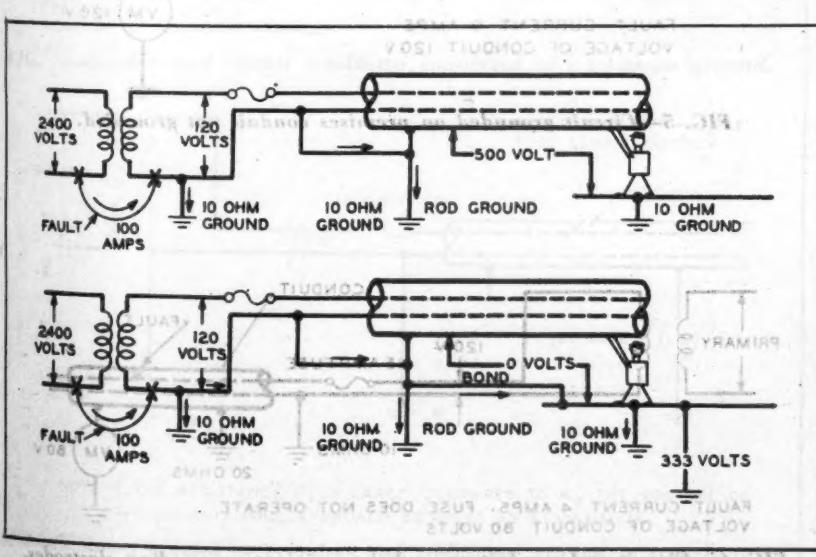


FIG. 3—Interconnection of grounding electrodes.

where due to the large circuit impedance, a 10-ohm electrode will provide as effective grounding as that obtained from a grounding electrode of much lower resistance where short urban circuits are involved.

It will be helpful to discuss a typical case involving a fault between a primary and a secondary circuit. In this situation, we have assumed a fault current of 100 amperes and a grounding electrode resistance of 10 ohms. As previously mentioned, such electrode resistances are frequently encountered. This is shown in Figure 2.

In 2(a) the secondary circuit and conduit are grounded by separate grounding electrodes, as was common practice a number of years ago. Under this condition, there will be 1000 volts between the secondary conductors and the conduit.

The idea of the separate grounds for circuit and conduit was to keep the conduit from being raised in potential at the time of a fault between primary and secondary circuits. However, experience has shown that the potentials resulting from faults with primary circuits will frequently cause insulation failure and also energize the conduit. In view of this (and also for other reasons as discussed later), it is now the practice to use a common grounding electrode as shown in 2(b). Under that condition, there will be no large difference of potential between the secondary circuit and conduit but both circuit and conduit would have a potential of 1000 volts to ground. Even with a grounding electrode having a resistance of one ohm, the voltage of the conduit with respect to ground would be of the order of 100 volts or more. It should be noted that the fault current of 100 amperes will operate the 50-ampere fuse shown in the primary circuit. For the condition given in Figure 2, the voltage would remain on the secondary circuit only for the short time required for the fuse to operate.

From the standpoint of high-voltage faults, the grounding of secondary circuits and equipment will always reduce the potential to some extent, but the main benefit results from the fact that the fault current will in general cause protective devices to operate and thus reduce the time that the high voltage remains on the circuit. It should be pointed out that even where the fault current is not sufficient to operate the overcurrent devices, arcing at the point of fault will often cause a conductor to part, thus opening the circuit.

Since very substantial ground potentials can occur as a result of faults involving primary circuits, the question naturally arises, "Are not such voltages hazardous?" Voltages substantially over 100 volts can in themselves be quite hazardous. However, from the standpoint of safety, it is not so much the question "How high is the voltage?" but rather "What is the likelihood of a person getting an electric shock?" or "What is the chance of starting a fire?" when such abnormal voltages occur. Experience has shown that high voltages to ground on secondary circuits and equipment resulting from faults involving primary circuits, *if of short duration*, do not constitute, under ordinary circumstances, a serious shock hazard. This is largely due to the fact that for a very short interval of time it is unlikely that a person will be in contact with a circuit or equipment and at the same time be in contact with an object grounded to another electrode. The possibility of arcing or overheating starting a fire is also small when the duration of the fault is short.

In suburban and rural areas, protection against lightning voltages is also of importance. The potentials on secondary circuits due to lightning may be several times as great as those en-

countered with faults involving primary circuits. Connecting the circuit to a grounding electrode, either directly or through a lightning arrester, materially reduces the potential and consequently minimizes arcing and insulation failures. In order to prevent excessive voltage and consequent insulation failures between conductors and conductor enclosures, it is necessary to use a common grounding electrode for circuit and equipment as discussed above. Even with relatively low-resistance grounds, the potential to ground due to lightning may be quite substantial. It might be pointed out that insulation failures resulting from lightning, where separate grounding electrodes are used for circuit and equipment, are a frequent cause of conductor or equipment enclosures becoming energized from secondary voltages. With separate grounding electrodes the fault current from secondary voltages will, as explained later, be generally so small that the fuse does not operate and the conduit or equipment remains energized until the fault is repaired or the circuit opened.

Safety may be further improved by so arranging the grounding that all metallic structures which can be touched or to which arcing might occur

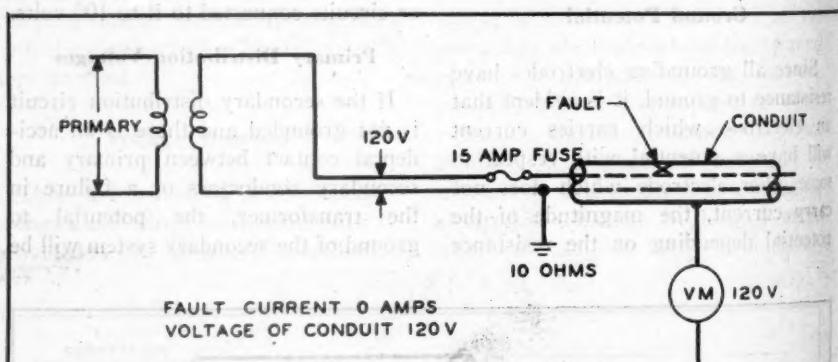


FIG. 5—Circuit grounded on premises conduit not grounded.

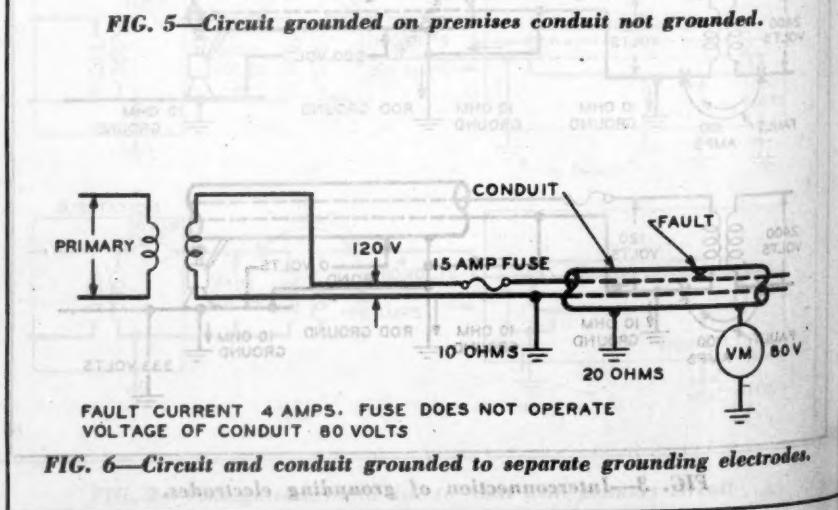


FIG. 6—Circuit and conduit grounded to separate grounding electrodes.

are connected to or form part of the same grounding electrode used for grounding the circuit. If all grounded metallic structures within a building are connected to the grounding electrode used for grounding the electric circuits, no large difference in potential can develop within the building. This is illustrated in Figure 3. It has long been the practice of power companies to bond together all metallic parts within a generating or substation area. Such interconnection is also approximated where a water piping system is used as the grounding electrode as discussed below.

Reason for Using Water Pipe Grounds

The use of underground piping systems in urban areas as a grounding electrode is well established. The reason why such water pipes provide the best grounding electrode and why it is necessary to use them for grounding the electrode circuit are well expressed in a paper, "Electrical Grounds on Water Pipes," presented by H. S. Warren at a meeting of the New England Water Works Association. He states as follows:

The reason why a continuous metallic public supply water piping system makes the best ground is not be-

cause such pipes have water in them but is due to the fact that such a piping system has by far the largest contact surface with the conducting material of the earth. In fact, where such a piping system exists, it is the earth, electrically speaking, for all practical purposes. The hazard to be protected against arises from the fact that voltages may accidentally be set up between different metallic objects in the house and that persons may be subjected to these voltages. Water pipes appear at numerous points through the house and are interconnected or in contact with steam pipes, gas pipes, etc., so that they offer numerous chances for people to get in contact with them. If some other grounding electrode were employed instead of the water pipes, the voltages between electric wiring, apparatus, etc., and this extensive system of pipes might be much larger and, hence, the hazard much greater. The very presence of these piping systems in a house increases the importance of using them as grounding electrodes.

Where so-called private water systems, that is systems supplied from local wells, are used, the presence of the water piping system in a building presents, in varying degrees, the same situation as outlined in Mr. Warren's

statement. It is recognized that in general the resistance to ground of such systems will be materially larger than for public systems. It is nevertheless important to use such a system as the grounding electrode or to bond it to any other electrode which may be used. There are several reasons.

(1) The use of such piping systems for grounding purposes, regardless of their resistance to ground, reduces the likelihood of difference of potential within a residence.

(2) If the water system is not used as the grounding electrode, large differences of potential may occur between the electric wiring and the piping system due to lightning, particularly in rural areas. Since it is difficult to have large separations between the water pipes and electric wiring, arcing due to lightning will occur at points of small separation. Such arcing, with power arc follow-up, constitutes a greater fire hazard than lightning alone where power wires are not involved.

(3) Most private water systems today have an electric pump with the motor frame in contact with the piping system. If the wiring system is not connected to the water piping systems, large potentials may develop between the winding and the frame of the motor due either to lightning or a fault involving the primary circuit. Such potentials frequently cause insulation failure and a cross between the live circuit conductor and the frame. As will be discussed later, where the resistance of the water pipe is more than a few ohms, such a fault will not operate the branch fuses and the water pipe will remain energized at a voltage approaching 120 volts. This latter situation is illustrated in Figure 4.

Effect of Grounding—Secondary Circuits

The Code requires secondary circuits to be grounded if they can be so grounded that the maximum voltage to ground does not exceed 150 volts. It has sometimes been stated that grounding secondary circuits (120-240 volts) increases the shock hazard from secondary voltages. It is argued that if the neutral were not grounded, a person touching, for example, a water pipe with one hand and a portion of the live wiring with the other, would be subjected to little or no voltage, whereas with a grounded neutral, the person would receive the full normal voltage. This is only theoretically true, since experience has shown that

[Continued on page 188]

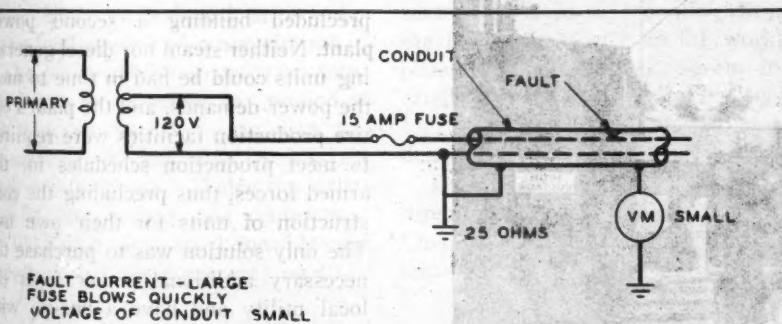


FIG. 7—Conduit and circuit conductor connected to a common ground.

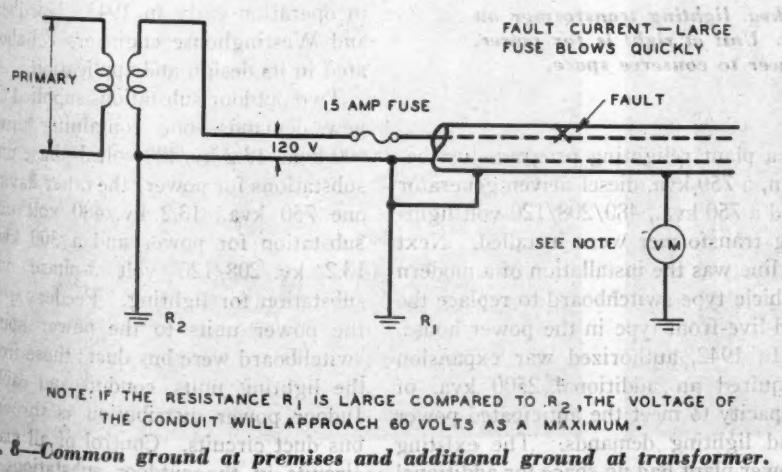
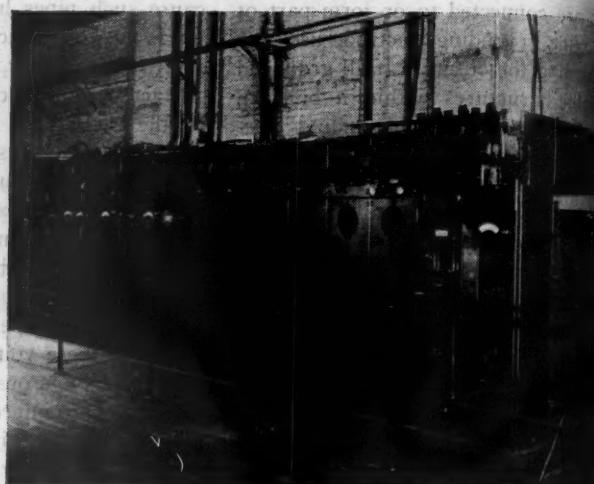
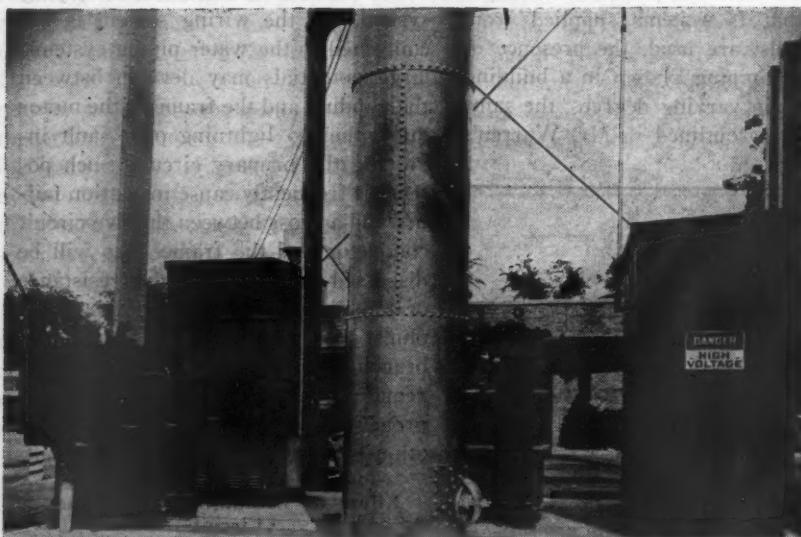


FIG. 8—Common ground at premises and additional ground at transformer.



In the power house this new switchboard (left); controlling all plant generated and purchased power (centralizing control panel second from left) replaced the old live-front board (right).

power plant's bus system. The unit is now generating power from the plant's own power plant. The unit is a 750 kva. diesel-driven generator with a 750 kva. lighting transformer. The unit is located at the base of the water tower to conserve space.



Outdoor unit substation showing a 300 kva. lighting transformer on the left which helps serve relighting load. Unit at right is for power. Equipment is located at base of water tower to conserve space.

REHABILITATION of a plant electrical system is not done in a day, nor even in a year. Up at the Nordberg Manufacturing Company, Milwaukee, one of the largest builders of diesel engines and other types of heavy machinery, such electrical rehabilitation has been in progress for the past five years. Back in 1940, the plant was generating about 1000 kw. of d-c and 750 kva. of a-c power. When, at that time, power demands took a sudden jump, due to the requirements

of a plant relighting program just begun, a 750 kva. diesel-driven generator and a 750 kva., 480/208/120-volt lighting transformer were installed. Next in line was the installation of a modern cubicle type switchboard to replace the old live-front type in the power house.

In 1942, authorized war expansion required an additional 2500 kva. of capacity to meet the anticipated power and lighting demands. The existing power plant had no space for additional generating units. Lack of ground space

PROGRESSIVE P

By August Eckel

precluded building a second power plant. Neither steam nor diesel-generating units could be had in time to meet the power demands, and the plant's entire production facilities were required to meet production schedules for the armed forces, thus precluding the construction of units for their own use. The only solution was to purchase the necessary additional power from the local utility and have a bus-tie with the plant generating system. This was arranged and the new equipment went in operation early in 1943. Nordberg and Westinghouse engineers collaborated in its design and application.

Two outdoor substations supplied the new demands—one containing three, 600 kva., 13.2 kv./480 volt 3-phase unit substations for power; the other having one 750 kva., 13.2 kv./480 volt unit substation for power and a 300 kva., 13.2 kv./208/120 volt 3-phase unit substation for lighting. Feeders from the power units to the power house switchboard were bus duct; those from the lighting units, conduit and cable. Indoor power distribution is through bus duct circuits. Control of all main circuits in the outdoor substations is centralized in a control cubicle in the



Center bay machine shop showing a relighted section (left) under a uniform intensity of illumination. Note old lighting of the same area (right) with its concentration in center aisle and harsh shadows on the machines.

PLANT RELIGHTING

Area by area, plant lighting at the Nordberg Manufacturing Company, Milwaukee, is approaching the modern standards demanded by an expanded production schedule.

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power house switchboard, as is automatic load control of other circuits.

The plant relighting program actually began in the center bay section of the large machine shop, an area approximately 80 feet wide by 600 feet long (20-ft. bays). Under the existing lighting system, one center row of 1000 watt deep bowl incandescent reflectors (on direct current) on 40-ft.

centers at a 35-ft. mounting height, the lighting intensity on the working plane barely averaged seven foot-candles. This was totally inadequate for the seeing tasks involved in this department.

The new lighting, installed under the direct supervision of chief electrician Carl Lau, consists of a staggered system of 1,000 watt, hi-bay, Alzak alumi-

num, incandescent units and 400 watt mercury vapor units mounted 40 feet above the floor level. In general, units were installed in four rows (compared to a single row in the old system) parallel to the length of the building. The initial spacing of 20 ft. by 20 ft. centers produced a minimum average intensity of 15 foot candles on the 36-inch working plane (measured when



Engine erection floor is now comfortably lighted by evenly spaced units (left). Note the effect of the white painted walls, trusses and roof. Photo at right shows the same area with the old lighting system encased in shadows.

the fixtures were dirtiest). In another section of the same area, the spacing was reduced to 20-ft. by 10-ft. resulting in a *minimum* average intensity of 20 footcandles on a similar working plane.

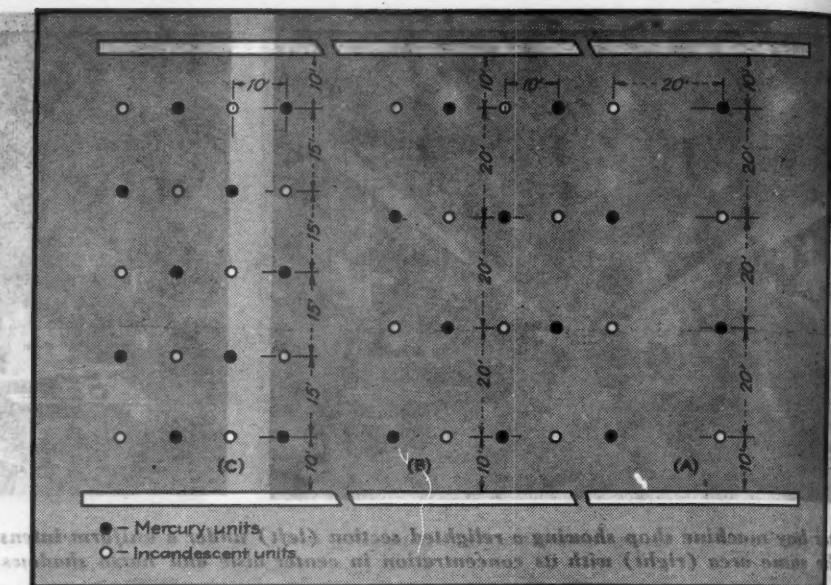
As war demands cut off the supply of aluminum, porcelain enameled reflectors had to be substituted for the Alzak units when other areas were relighted. To maintain the same average intensity with these units, the spacing was reduced to 15-ft. by 10-ft. centers.

The same general scheme of relighting was employed in the oil engine erection area and in the main erecting floor where the mounting height is 45 feet. Minimum average footcandle intensities are essentially the same. In all relighted areas harsh shadows have disappeared under the evenly distributed intensity of illumination, eye strain has diminished and employee morale has taken an upward swing, as has production efficiency.

Paint Aids Lighting

To increase reflection factor, and hence the overall efficiency of the new lighting system, all steel columns, trusses and roof structures in the relighted areas were painted white. Plans contemplate repainting every two years—the actual time depending, of course, upon atmospheric conditions in each specific area.

The old direct current lighting was left intact to serve as an emergency system in the event of failure on the alternating current circuits. It might be well to explain the significance of



Typical layout showing the staggered system of incandescent and mercury vapor units employed in the relighting program. Various spacings used are indicated in sections A, B, and C.

the term "minimum average intensity" as employed here. It is a value which takes into consideration depreciation due to lamp life, dirt and dust. Such readings are taken after the system has been in operation from eight to twelve months and at a time immediately preceding cleaning of the units. By doing this, chief electrician Lau contends that he is assured of knowing at all times what minimum light output can be contemplated in each department. By considering this value when originally designing a system, he avoids having any area grossly under-illuminated when the fixtures need cleaning. Increase in light output after each clean-

ing is a temporary gain which diminishes as each maintenance period approaches. The "minimum average intensity" value he uses is a fairly static figure on which he can rely. It is the sound basis on which he designs his plant lighting systems.

The relighting discussed above covers a large portion of the Nordberg plant. But there are still other areas to be revamped such as foundries, and other locations where better lighting can be used. These are being progressively relighted as other sections will be until the entire plant lighting is brought up to the modern standards established by technological advances.



Vise department lighting under the new system (left) with its even distribution and white painted steel compared to the old system (right) depending upon side lighting for over-all illumination.

WIRING REFRIGERATED BARGES

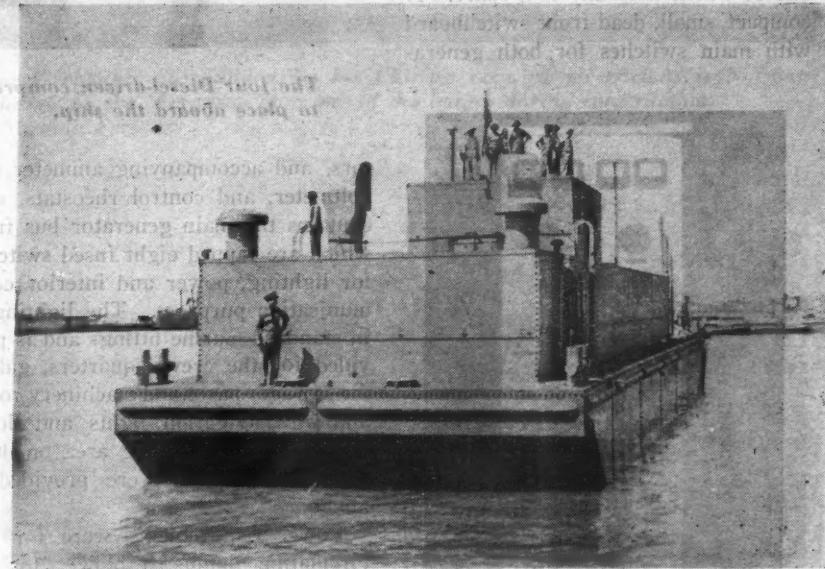
A California contractor wires the ships that bring fresh foods to fighting fronts in the Pacific.

By W. A. Cyr

It isn't all K rations in the South Pacific War. By a combination of American ingenuity, experience and versatility, fresh foods, frozen of course, are brought close to the fighting fronts almost with the troops themselves these days. And one of the ingenious methods for doing this is with the refrigerator barge.

It fell to the California Electric Works of San Diego, Calif. to participate in an unusual way in the development of these barges which are now serving the army in the Philippines and other Pacific outposts. For its experience in electrical construction and its versatility were called upon to help develop, then build, then devise a knocked-down model of such a barge in some quantity for shipment across the Pacific. It also fell to its lot to participate in the reassembly and testing of these barges close to the point of action.

Many contractors have participated in war contracts, building plants and installing electrical facilities. Many



Aft view of the completed barge in the water after the launching.

have mass-produced the electrical installations on ships and barges. However, this job was unique in that one of its designers, Norman Ferguson, construction manager for California Electric Works, was given specialists' rating in the army, put into uniform, flown to Australia and from there with his fellow specialists supervised the reassembly and testing of the first refrigerated barges the army had ordered for that theatre of operations.

Early in 1944 the National Iron Works of San Diego was given orders to make up one such barge as a pilot. General specifications were provided but the practical engineering of the details was left to it and its subcontractors. These were the California Electric Works for the electrical facilities, E. Willardson for the plumbing and Kahlenberger Refrigeration Company of Fullerton for refrigeration equipment.

A standard 104 by 29 by 8 ft. barge hull with flat bottom was the craft selected for the first barge. On it was

to be mounted the deckhouse 85 by 22 by 8 ft. and above this the crews' quarters for four in a housing 15 by 17 feet.

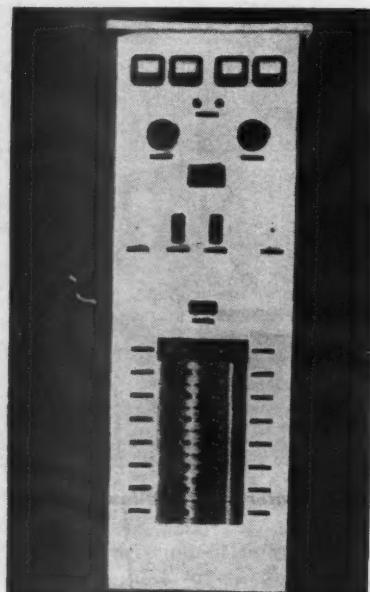
The hull was divided into four compartments, each accessible to the other by sealed hatches. The refrigerated storage, held at temperature of 10 deg. F. was located in these compartments in the hull.

For dry storage and a daily issue room, kept at 40 deg. F., the deckhouse was to be used. A portion of this deckhouse was also assigned for engine room and was to contain the Diesel engines, generators, refrigeration compressors, switchboard and control. This was located aft of the storage space. Crews' quarters on the third deck contained a mess hall and galley, heads and showers, as well as CPO bunks for four crew members.

The electrical job, while not large, is exceedingly important and chiefly it is to serve the refrigeration system, provide lighting, a signal and alarm system and to supply power for a deck

hoist. The main refrigeration plant consisted of four Diesel-driven compressors. For the dry storage space, air is blown across cold coils by a blower unit powered by a three hp. motor. However, for the main refrigerated compartments, refrigerant coils were used. The compressors were so arranged that three would operate at a time to carry the load, permitting one to be down either for stand-by or repairs.

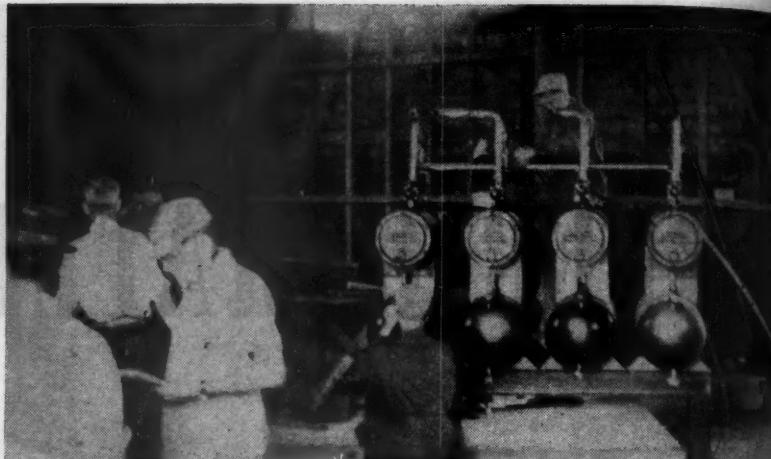
The electricity supply comes from two 10 kw. Diesel-driven generators, one of which normally is a spare. A compact, small, dead-front switchboard with main switches for both genera-



Compact one-piece switchboard ready for assembly in one of the barges.



Interior of one of the cold storage rooms showing three panels for refrigeration control each with solenoid-operated valves.



The four Diesel-driven compressors for one barge being assembled ready to place aboard the ship.

tors, and accompanying ammeter and voltmeter, and control rheostats, also contains the main generator bus from which are tapped eight fused switches for lighting, power and interior communication purposes. The lighting is in standard marine fittings and is provided for the crews' quarters, galley, the storage spaces and machinery room, and for navigation lights and flood-lights over the loading area on deck. Blackout switches were provided at all doors.

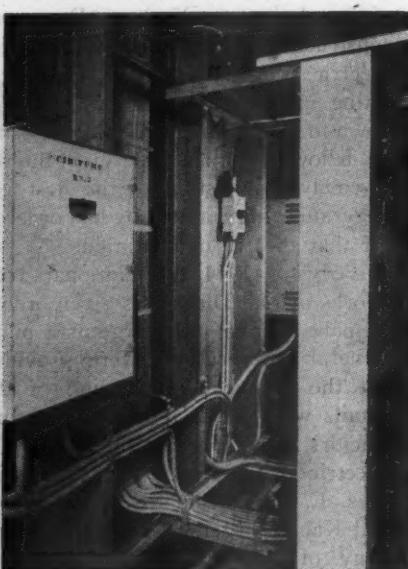
Power requirements were for two circulating pumps, a blower for the air unit, vacuum pumps, oil pumps, exhaust fans and fire pumps. In the communications circuit there was a general alarm system, an automatic refrigeration control system, and communication by telephone between various portions of the barge. The gen-

eral alarm system sounds horns in all compartments, the crews' quarter and on deck. The refrigerator alarm system gives warning of the shutdown of any refrigerator compressor or may be sounded in case of trouble from any portion of the barge. The refrigerant used is Freon, which is non-toxic.

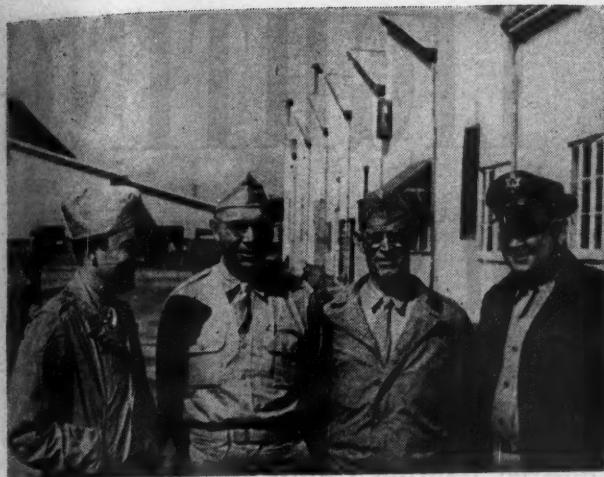
While the first barge was being given severe tests in and around San Diego by the Army, others were being fabricated in sections for shipment. The reasons for shipping in knocked-down parts were numerous. These parts could be stored on land near advanced bases and assembled when needed to be put into service. Transportation of them could be speeded in this way since the towing of a barge is slow, whereas the parts could be shipped by faster freighters. In order to assist the assemblers to put the parts together full directions were printed in book form to accompany the shipment. All crated for shipment, each barge required about eleven 50-ft. railway cars. On assembly the sections were bolted together.

These mobile storage bases can be moved with the troops as they advance instead of setting up refrigeration plants as temporary bases. They are usually towed to a place near the advance base and anchored. Supplies are brought to them frozen from a refrigeration mother ship. They are designed to operate for three consecutive months without refueling or rewatering. They carry about 400 tons of cargo and weigh about 250 tons empty.

It was decided by the army that for the first few of these barges the designers themselves would be flown to Australia to supervise the assembly and to make the initial tests. Greer



As assembled, the switchboard in place, together with the cable from it and from a separate panel for the circulating pump.



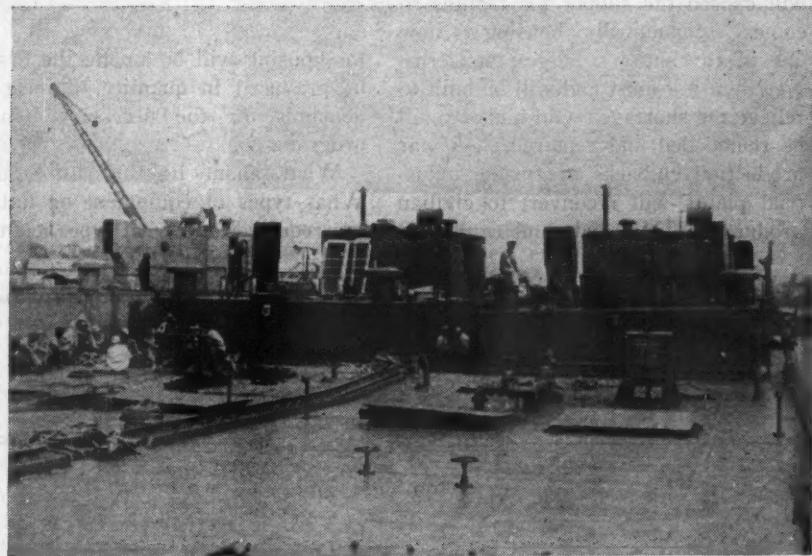
Three of the contractor specialists with Major Firebaugh Surrounded by his Chinese crew of electricians is Norman (right) of the U. S. Engineers' Corps in charge of the Ferguson atop one of the barges during construction. construction in Australia. Left to right are Norman Ferguson, California Electric Works, San Diego; Joseph Bernudas, Kahlenberger Refrigeration Company and William Sweigart of E. Willardson Company, Plumbers.

Fever, National Iron Works, Norman Ferguson, California Electric Works, William Sweigart of E. Willardson Company and Joseph Bernudas, Kahlenberger Refrigeration Company were thus given specialists' ratings, innoculated, generally processed, put into uniform, and one day last Fall were flown to Australia. There the parts for the barges had been shipped. It was their job to supervise reassembly.

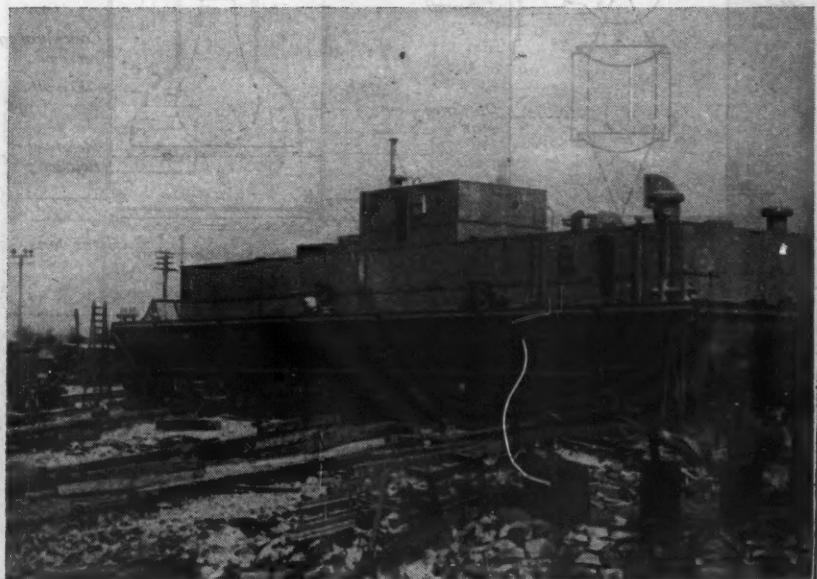
It proved a good thing that they did so, for some of the equipment was damaged in shipment and therefore had to be placed back in working condition. Likewise, some of the assembling crews were Chinese and the assembling directions might have been confusing to them. At the shipyards in Melbourne, Australia, the barges were put together and tested.

An unexpected experience was accorded them when, after the barges had been assembled and tested, they were flown to Port Moresby and later to Milne Bay. There they awaited the towing of the barges they had assembled, and when they arrived there at the end of a 2,000 mile sea voyage, they were enabled to check on the performance of the equipment, the ruggedness of the design and observe how the barges had weathered this pounding by the sea.

And while they were waiting, the Colonel in charge, taking advantage of their technical knowledge and experience, drafted them to prepare plans for more permanent advanced bases. This gave them great satisfaction in being of further value to the war.



Several of the barges during the assembly in the Australian shipyards.



Ready for launching, one of the refrigerated barges reassembled in an Australian shipyard.

RESIDENCE LIGHTING

TECHNIQUES

NEW housing, and remodelling of old housing, is now a nationwide topic of discussion. Government agencies, manufacturers, distributors, builders and contractors, and the public, are all interested.

According to War Mobilization and Reconversion Director Vinson's report to the President and Congress, following V-E day, housing is one of three vital phases of American living (food, clothing, shelter) in which the demand will exceed the supply for months to come. Economically, housing is now one of the nation's biggest concerns. New housing must and will be built to relieve the shortage. Old housing will be remodelled and repaired. As war production cutbacks are made, industrial plants will reconvert to civilian production. Materials and equipment

A discussion of lighting requirements and review of some lighting techniques which will produce desired lighting results in the home.

By Berlon C. Cooper

for housing will be among the first to be produced in quantity to meet the demands for the necessary housing program.

What about lighting for homes? What types of equipment or fixtures are required, and what types are most

desirable? Will fluorescent lighting be used to provide the necessary lighting result for the home?

Many surveys have already been made to determine the answers to these and many other similar questions. Other surveys are under way. About one home in ten now has fluorescent lighting in one or more rooms. Users of fluorescent fixtures plan to buy more for other parts of the house. The majority of installations have been made in kitchens, and new customers list the kitchen as first place for fluorescent when suitable type units can be had. The bathroom comes next in importance with home owners as a place for fluorescent, followed by bedrooms.

Manufacturers are now busy designing fluorescent lighting fixtures specifically for residence lighting. The trend in design is varied, and away from the now prevalent commercial fixtures.

Home owners, working in war plants and offices, and buying in stores lighted to higher illumination intensities with fluorescent lighting, have accepted it as desirable. They want it for their homes, for the kitchen and bath, for the playrooms and home workshop, and for other rooms of the house. Predictions based on surveys

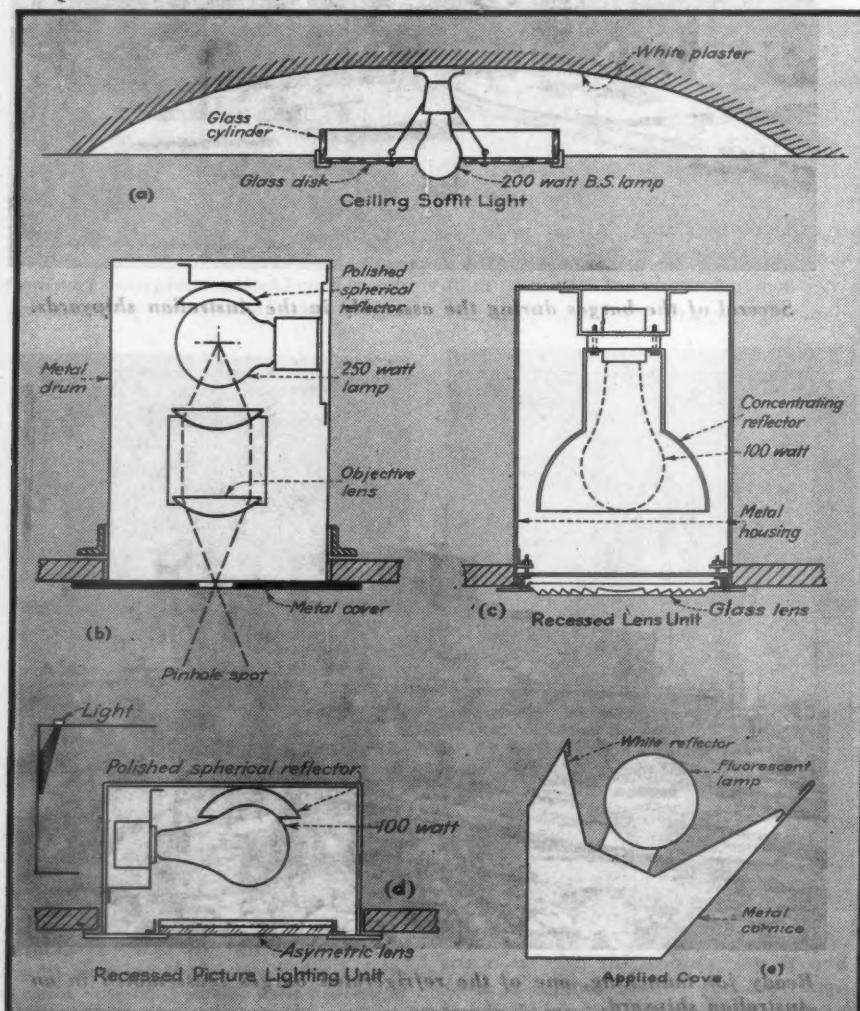
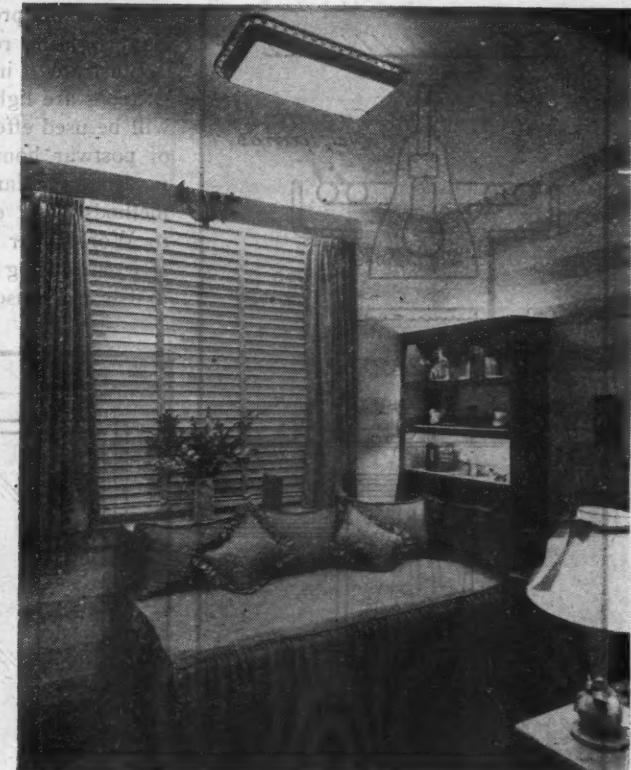


Fig. 1—Examples of architectural and built-in lighting for the home. Soffit light (a) is suitable for the living room or study. The (b) and (c) recessed units will highlight the dining room table, or light work areas. Cove (e) is suitable for many rooms.



Kitchen sink is lighted to 35 footcandles by a two 40 watt lamp fluorescent louvered unit recessed flush in ceiling over window. Two recessed units, each with two 40 watt lamps, provide general illumination in L-shaped room.



Fluorescent lamps concealed behind valances in this studio bedroom creates comfortable, decorative atmosphere. This lighting technique is also applicable in living and dining room. Fluorescent lamps concealed in bookcase provide useful light and are decorative.

have been made that every fourth wired home will have fluorescent lighting in one or more rooms by 1950.

Incandescent lighting will continue to be used by many, especially in decorative equipment and in portables.

Lighting requirements in the home are many and varied. High level intensities are needed for the kitchen, sewing room, laundry, workshop, and for reading, writing and similar home activities. Proper color quality is necessary for such locations as the vanity and bathroom mirror, over the ironing board, and on the dining room table, for utilitarian purposes, as well as throughout the home to create the proper decorative treatment. Lighting intensities and lighting effect should be flexible to meet varying moods, and activities.

As in the school, office, or factory,

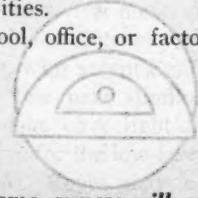
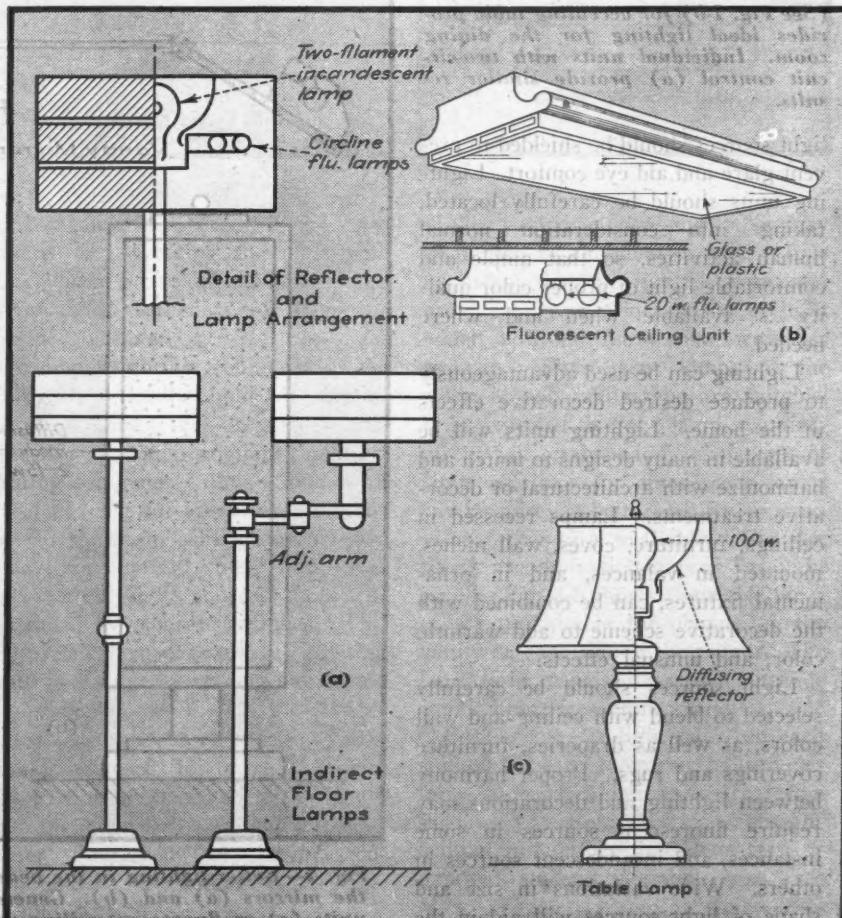


Fig. 2—Many home owners will continue to prefer floor and table lamps for lighting the living room or study. Fluorescent ceiling units (b) in many styles and designs will become popular in the home of the future for living room and bedroom.



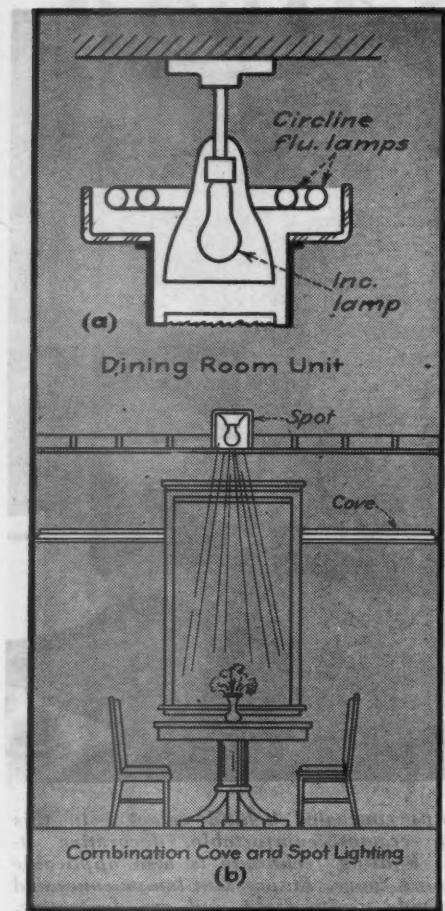


Fig. 3—Use of cove lighting for general illumination, with pinhole spot (See Fig. 1-b) for accenting table provides ideal lighting for the dining room. Individual units with two-circuit control (a) provide similar results.

light sources should be shielded to prevent glare and aid eye comfort. Lighting units should be carefully located, taking into consideration normal human activities, so that ample and comfortable light of proper color quality is available when and where needed.

Lighting can be used advantageously to produce desired decorative effects in the home. Lighting units will be available in many designs to match and harmonize with architectural or decorative treatments. Lamps recessed in ceilings, furniture, coves, wall niches, mounted in valances, and in ornamental fixtures, can be combined with the decorative scheme to add warmth, color, and unusual effects.

Light sources should be carefully selected to blend with ceiling and wall colors, as well as draperies, furniture coverings and rugs. Proper harmony between lighting and decorations may require fluorescent sources in some instances, and incandescent sources in others. Wide variations in size and shape of light sources will aid in the

selection of proper sources for the many lighting requirements.

Illustrated in the accompanying sketches are lighting techniques which will be used effectively in the lighting of postwar homes, both new and remodelled. Many of the units and methods were coming into use prior to World War II, but have been restricted during the war in order to assist in conservation of materials.

The sketches have been made to indicate principles of good lighting applicable to the home, without regard to artistic or period design. Materials, finishes, ornamentation and period designs will be made in various combinations by producers to meet the decorative and cost requirements of the market. The inherent principles of control and application indicated in these sketches will, however, obtain in

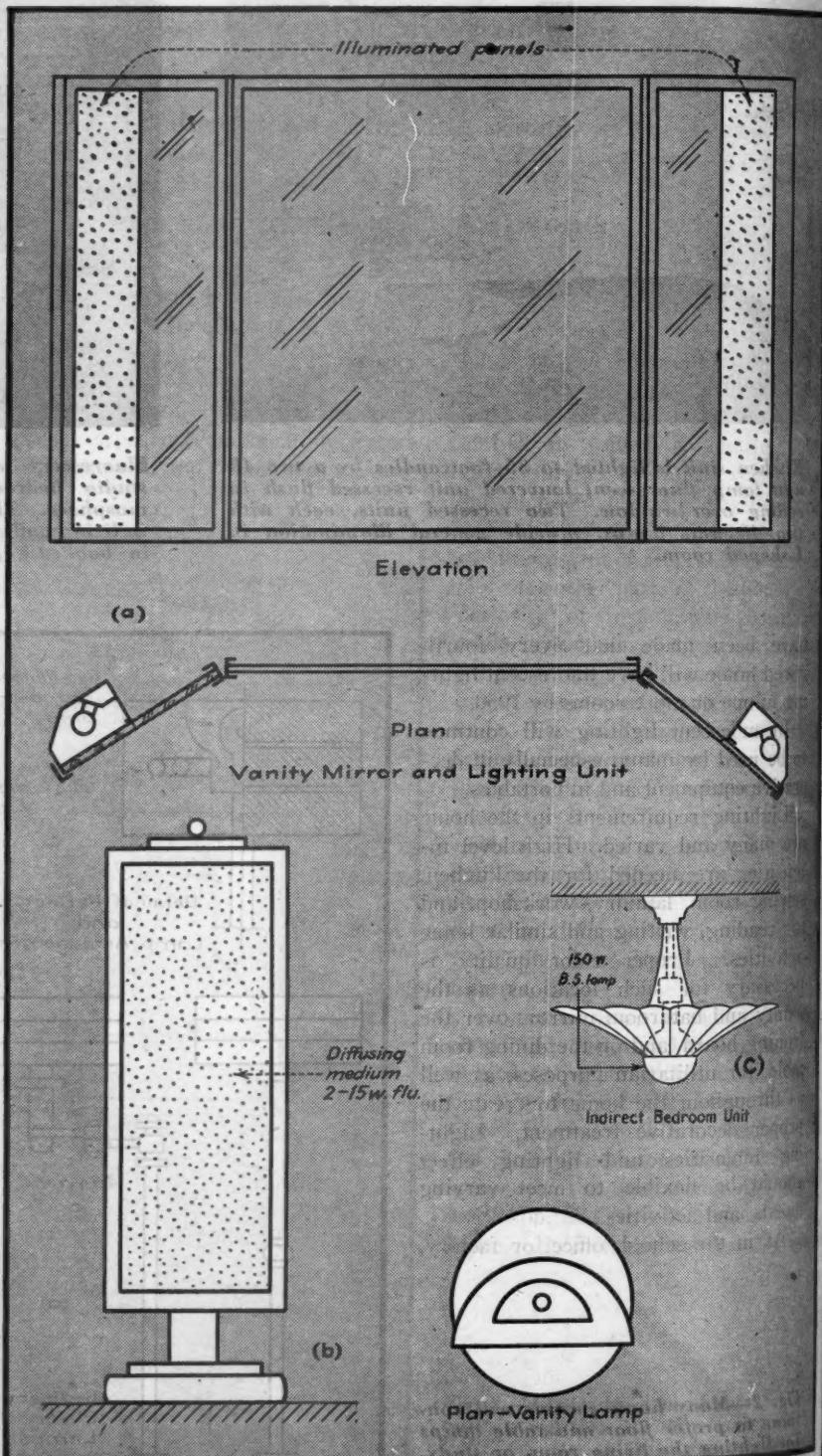


Fig. 4—Better lighting in the bedroom can be had with proper lighting for the mirrors (a) and (b). General illumination from incandescent ceiling units (c) or fluorescent ceiling units (see Fig. 2-b) is desirable.

the lighting techniques employed in providing satisfactory lighting results in the well lighted homes of the future.

Living Room. Flexibility in intensity and lighting result should be provided for in the living room. Glare-free general illumination should be provided by a center ceiling unit, either fluorescent or incandescent, of decorative design and finish to harmonize with the general decorative treatment. For the more elaborate type living room, shallow coffers with appropriate design incandescent units are very effective and satisfactory (see Fig. 1-a). Fluorescent lamps concealed behind the window valance (see Photo) will highlight draperies and add decorative interest. Cove lighting with fluorescent may also be used for general illumination or accent lighting for portions of the ceiling. Decorative table lamps using incandescent lamp bulbs add highlights of interest and a feeling of warmth and comfort. Portable floor lamps placed beside chairs and other seating units, when equipped with reflectors for indirect illumination, provide additional light for close work, such as reading, sewing, and card playing. These lamps may be equipped with the new circline fluorescent tubes, with separate switch control, for low level decorative lighting. Murals or other wall decorations may be lighted from recessed directional incandescent lens units (see Fig 1-d), or continuous line louvered fluorescent flush troughs. Reverse coves may also be used for highlighting a wall.

Dining room—There is a trend to combine dining rooms and living rooms in new residences. Where this is done, the lighting effect should follow through both rooms. If a center ceiling fixture is used in the living room, a harmonizing ceiling fixture would be suitable over the dining table. If no ceiling fixtures are used in the living room, inconspicuous flush lighting units used over the dining table (see Figs. 1-b and 1-c), provide effective lighting.

The desirable lighting result for the dining room, in either a new home or remodelled one, is a low intensity of general illumination, with accent lighting on the table. The new slimline fluorescent lamps make cove lighting practical and effective for the low level general illumination. Coves may be made of metal and applied to the wall, or may be made of plaster, wood or other building material as part of the building construction. Indirect wall urns may be used in lieu of cove light-

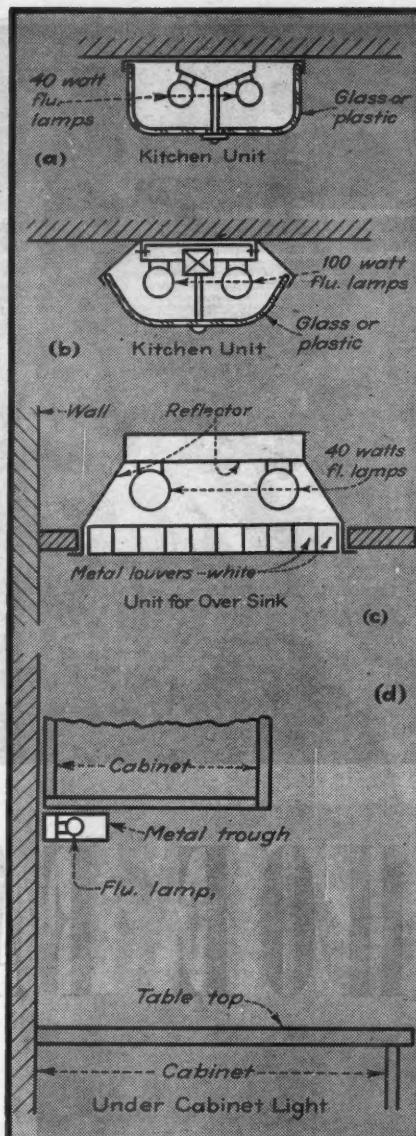
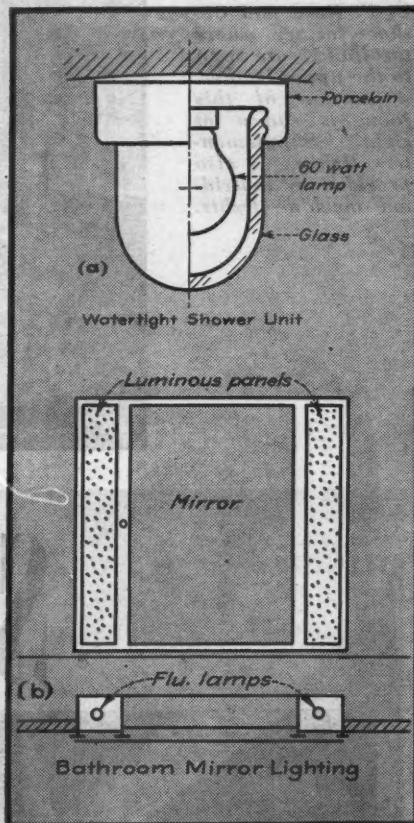


Fig. 5—Shielded fluorescent units to provide general high level lighting in the kitchen are shown above (a), (b) and (c). Localized lighting on work tables also uses fluorescent lamps (d).

Fig. 6—Long light panels at mirror, or circline lamps around the circular mirrors provides shadowless illumination for shaving or applying make-up. Watertight units should light shower stalls.



ing. Pin hole spots (see Fig. 1-b) are effective in accenting the table with direct light. Use of daylight lamps gives added whiteness to linen and sparkle to silver.

A simple lighting technique for the dining room, easily applied in relighting of old homes, is to use a single suspended unit which combines indirect lighting for general illumination, with direct lighting for accenting the table. Fig. 3-a shows the principle involved in such a combination unit. The direct and indirect light sources should be controlled by separate switches. This will permit the user to obtain a lighting result applicable to varying moods and requirements.

Bed Room—A center ceiling light should be used to provide general illumination in the bed room. It should be of the indirect or semi-indirect type. Either fluorescent or incandescent light sources are suitable (see Figs. 2-b and 4-c).

The vanity or dressing table may be lighted in a number of ways. It is important that the light sources used provide a good color quality of light which will aid the woman with her makeup. Fluorescent lamps of the white or soft white type are suitable. It is expected that the lamp manufacturers will produce additional types of lamp coatings for fluorescent lamps having an even better quality, as soon as materials are available. Fig 4-a shows a combination mirror and light panels. Fig. 4-b shows a portable lamp of a type suitable for placing on the vanity on each side of the mirror. The long light panels illustrated provide ample light, free from shadows.

Bath Room—A light panel on each side of the bath room mirror provides high intensity illumination free from shadows (see Fig. 6-b). A watertight ceiling unit, either flush lens type or exposed surface mounted type (see

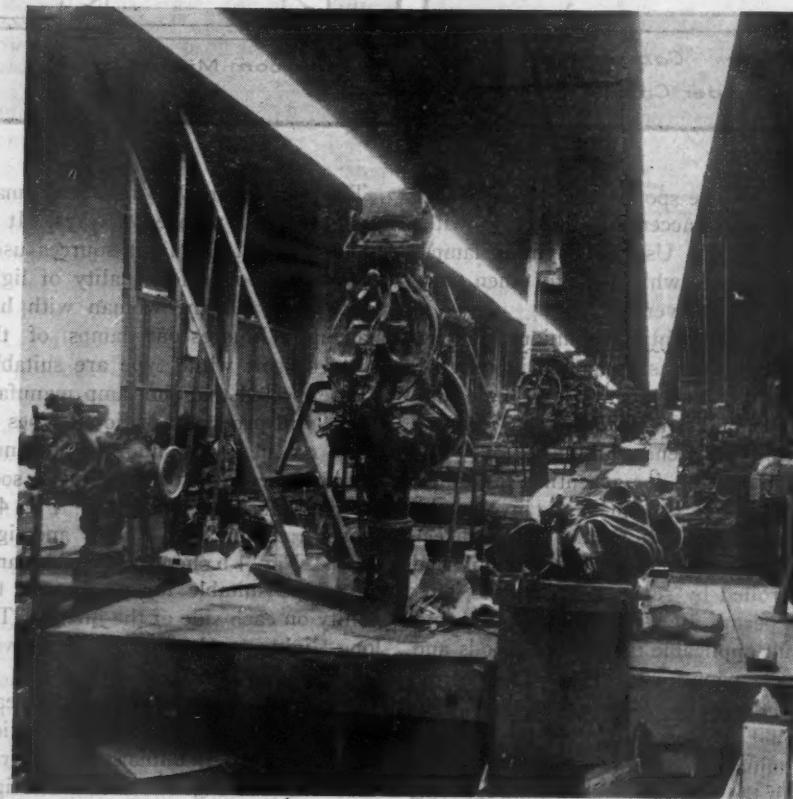
[Continued on page 186]

at other intersections, both
in general level light (a),
(b) strobe mode and
down to general baseline
(c) equal intensity.

ordin to along high
valence and known as
mainly as follows with
Forty footcandles of
general lighting are
provided in the
stitching room,
E. P. Reed and Co.
shoe factory where
the linings are sewn
to the upper leather.
A portion of this
room is shown at
right. Supplementary
lighting is also
provided by individual
machine lights.



SHOE FACTORY



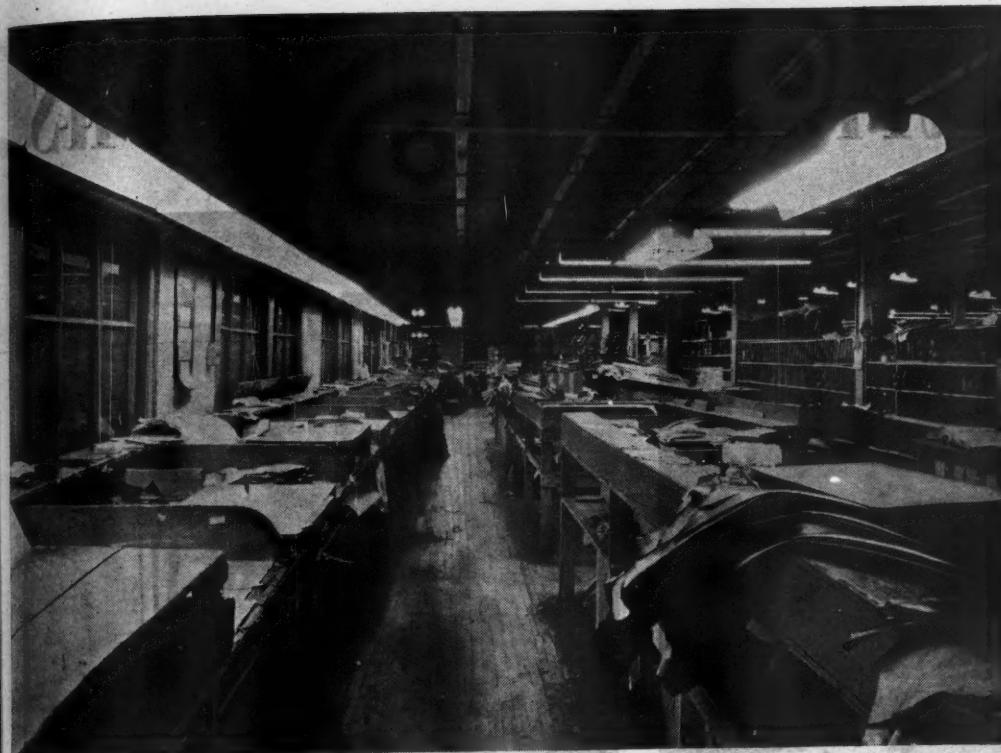
Spaced six feet apart, two continuous rows of fluorescent units, each 136 feet long, provide 50 to 60 footcandles of comfortable lighting in the lasting department. Rapid moving machinery demands that workers be able to see quickly and easily.

**Wiring and lighting in the
E. P. Reed and Company
plant at Rochester, New
York, modernized by T. H.
Green Electric Company.**

LAST year when additional machinery was installed at E. P. Reed and Company, at Rochester, New York, it was found that the wiring system simply couldn't carry the load or do the job required. A rewiring and relighting installation was made by the T. H. Green Electric Company.

The electrical system comprised both direct current and alternating current. Since the major use of the direct current was for lighting and was not adaptable to the operation of fluorescent lamps on an efficient basis, it was decided to eliminate as much of the d-c as possible.

Long individual runs of wire from panels to motors and lights were eliminated by the installation of a 30 foot length of bus distribution system on the ceiling of the third floor. This



ELIE

Over 100 footcandles of cool, glareless lighting results from a continuous row of fluorescent units over the cutting bench. This is one of the most critical work points in the plant, since the worker must be able to detect flaws and color differences in the leather quickly.

Y MODERNIZES

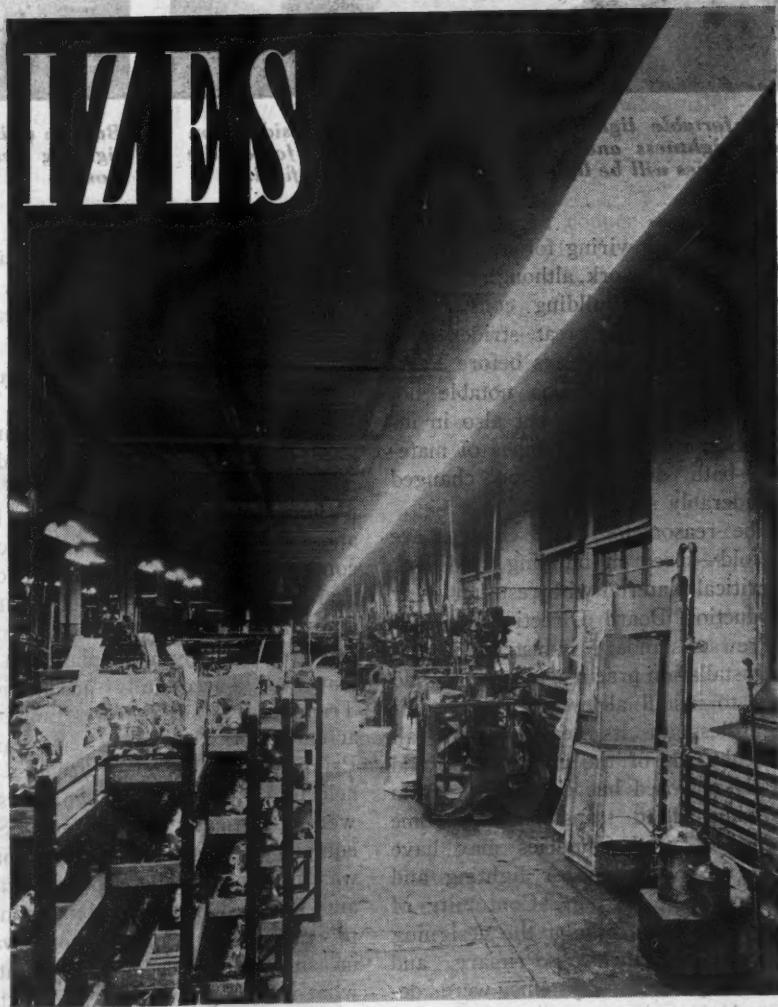
By

R. Bruce Thompson

Industrial Department
Rochester Gas & Electric Corporation
Rochester, New York

three phase, four wire bus of 600 ampere capacity now furnishes the power for all the machinery on the second, third and fourth floors, as well as the four lighting panels on each of the four floors.

A complete fluorescent lighting system for the factory was selected because of the ability to obtain higher foot-candles at a lower operating cost than was possible with other type systems. The facility with which fluorescent units may be installed in continuous runs was also desirable since it meant fewer branch circuits. The ability to operate fluorescent units on a 208 volt system was another advantage as it provided greater circuit capacity and meant a considerable saving in wire. The new lighting installation provides from 30 to 115 footcandles on the work,



The continuous line of fluorescent lighting shown above is 298 feet long. It provides 50 to 60 footcandles of shadowless, uniform illumination on the work points of machines in the welt department, E. P. Reed and Company shoe factory, Rochester, New York.

Electrical Installations



Comfortable lighting at the work with consideration of brightness and contrast in addition to footcandle intensities will be lighting engineer's postwar field.



Built-in units will be the trend in the postwar residential lighting field both for functional and decorative purposes.

ELECTRIC wiring for light, power and signal work, although the newest of the building construction trades, had made great strides in a comparatively few years before Pearl Harbor. Progress was notable not only in its application but also in installation methods and types of material—both of which have changed considerably since the war.

The reason for these changes are twofold—speed in building, and lack of critical material with resultant War Production Board Directives.

Prewar standard industrial electrical installation practice, in general, had been to install all wiring in conduit regardless of its service, with all switchboards of the cubicle type and totally enclosed bus connections from switchboard to transformers. Some steel mills and foundries may have been the exception for lighting and power feeder wiring. Continuity of service was the aim of the designing electrical engineer. Primary and secondary feeder systems were designed to prevent a production shutdown due to electrical failure. The plant operating engineer's desire was to have his plant so wired that he

could always maintain full production regardless of an electrical outage. The extra feeder cables, transformer capacity, switching equipment, etc. were always considered a guarantee of uninterrupted production. This procedure was a form of accident insurance—desirable even if the need for it never arose.

Such designs, however, froze large amounts of critical materials such as copper and steel. The War Production Board decided to forget the insurance angle and use this inactive material to wire many more plants—a goal that was successfully accomplished. Transformer sizes were limited to actual working load requirements. Primary and secondary feeders were held to a minimum. Network systems were practically eliminated. Spare equipment was ruled out. Conduit was prohibited where branch circuit and feeder wiring could be run exposed. Other material conservation measures were used. You might ask what is wrong with this. Admittedly, it is a workable system, and the equipment is operating day in and day out at full capacity—generally 24 hours a day. However, if a feeder, breaker, or

transformer fails, interruption of unknown duration may occur until temporary material or equipment can be obtained, installed and connected. This is not too serious in the overall picture of the complete war production program because some other plant making the same material is carrying on during this shutdown. Also—and this is important—this other plant has been in continuous production because it has been wired with the electrical equipment which normally would have been standby, spare, or part of a complete system in the plant in question.

The picture changes, however, when the critical material situation is a thing of the past and the postwar period emerges with its highly competitive private business enterprises. Take the automobile industry, for example, with its new models each year—or any other seasonal business. The motor corporation cannot afford a shutdown of any duration under any circumstances. It must maintain uninterrupted production to fill the orders by a promised date or the business will go elsewhere.

Therefore, it is our opinion that a tremendous number of plants should

POSTWAR

2001

The chief electrical engineer of one of the country's largest architectural and engineering firms expresses his views on postwar trends in electrical work.

By V. C. Wagner

Chief of Electrical Department
Albert Kahn Associated
Architects and Engineers, Inc.
Detroit, Michigan



Truss mounted lighting panels will give way in postwar design to conventional floor level panels with individual circuit control dictated by economical operation.

and will, as soon as material conditions permit, start to convert their electrical installations from their present emergency form to the best workable continuity-of-service design dictated by good engineering practice. There appears to be no other course to follow in the years of productive competition ahead. The insurance is necessary and economically sound, based on the premise that electricity and its application is the mainspring that makes a production plant tick. Water, gas, compressed air and steam are important but they all depend on electricity for their control.

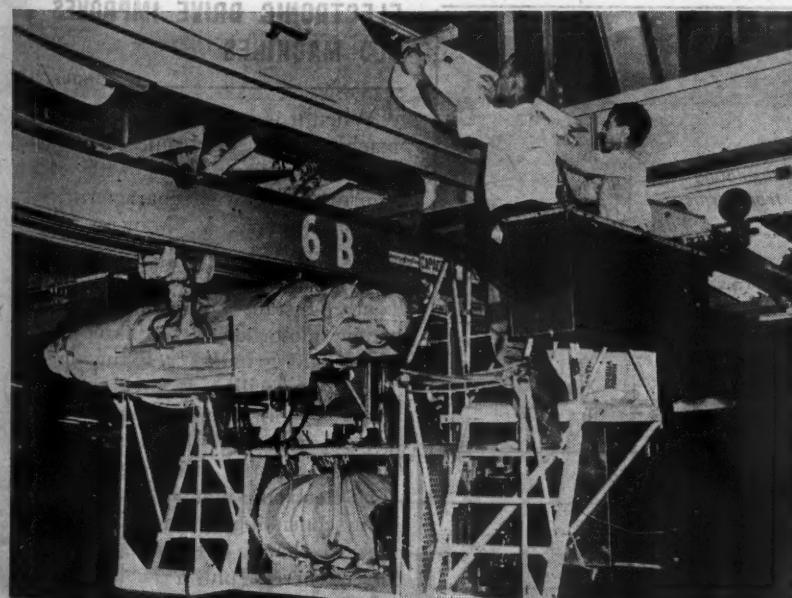
In the lighting field the changes have not been so great. Existing intensities, though ample, will be increased in many locations. Through increased knowledge of the usefulness of light more attention should and will be paid to the matter of seeing. We have been footcandle conscious. Certain intensities have been set up as the standards for offices, drafting rooms, machine shops, etc. This is a step in the right direction, but is only part of the story and does not go far enough. Whether or not an object is visible depends on its size, the background, the time allowable to see the task and other factors.

All these require special consideration. No general lighting system can or has been designed to serve all purposes. Due to the War Production Board restricting fluorescent lighting to productive areas, no doubt many office areas also will be changed from incandescent to fluorescent in the postwar period.

To conserve copper in many war plants designed for full area production lighting panels were installed in the trusses with all circuits remote controlled by one contactor in the panel. This procedure saved thousands of pounds of copper in vertical switch legs normally installed with wall panels and individually controlled circuits. In the postwar period, when some departments may be working while others are not operating, economy will again dictate that the lighting circuits or department lighting be individually or group controlled.

Many fine and efficient lighting installations have been designed to produce a certain intensity based on an established maintenance factor. Manpower shortage has made it impossible to maintain these installations at their highest efficiency. Also mounting heights and the increased number of fixtures per unit area have boosted maintenance costs. These costs will become more important in the highly competitive postwar markets. The result will be a greater interest in equipment for, and designs of, installations which give maintenance far more consideration. Instant start 40-watt

[Continued on page 117]



Postwar attention will be directed to fixture and system designs that give more consideration to economical maintenance.

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

SAFETY CONTROL WIRING

WIRING

One of the maintenance safety rules of the Eastman Kodak Company, Rochester, New York, states that the safety switch must be opened and padlocked before working on a machine. It is recognized, however, that uninformed or careless workmen may occasionally work on machines without opening the safety switch.

As an added precaution and safety measure, a circuit has been developed and used by this company with satisfactory results for a number of years which prevents a motor from starting due to an accidental ground. This circuit is shown in Fig. 1.

"Accidental grounds should not be tolerated, but we know of no way to positively prevent grounds from occurring now and then at some unpredictable time and place", states Eastman's maintenance electrical engineer, J. A. Gienger. This company believes that where a personal injury may be prevented, the protective circuit shown is well worth the expense and inconvenience that may be involved.



Control cable is brought via separate trays from the rectifiers to the central control panel of Aluminum Company New York City plant. Here the cable is being taken from the trays and carried over to the center of the building and up into the central control panel on the floor above. Note how the cable is carried across on enameled pipes and each cable is separately lashed to each pipe.

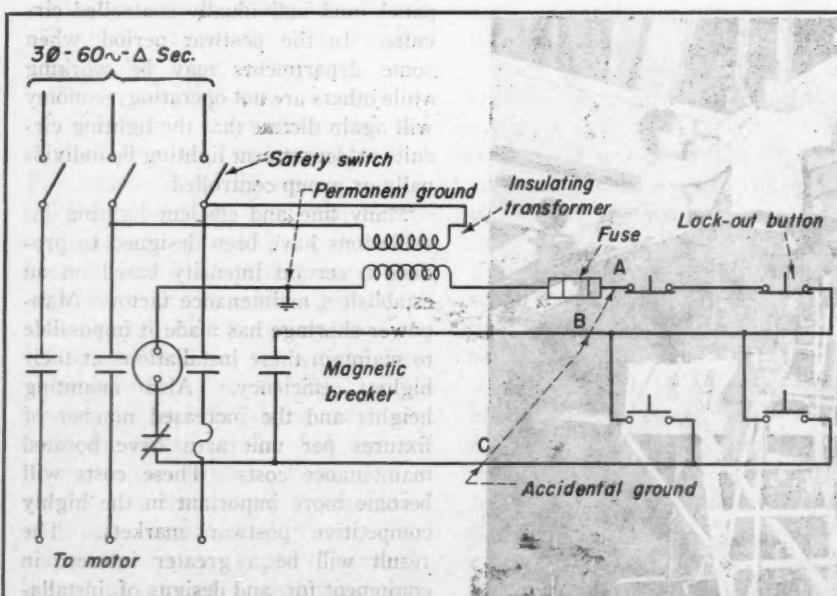


Fig. 1—Safety circuit used by Eastman Kodak Company, Rochester, New York, as protection against accidental grounds. Grounds at points A, B or C will blow fuse but will not start motor.

ELECTRONIC DRIVE IMPROVES OLD MACHINES

INDUSTRIAL

When it is impractical to obtain new machine tools, electronic control often provides old machines with greatly improved operating characteristics.

For example, V. Mancuso, Works Manager, Axelson Manufacturing Company, Los Angeles, California, recently installed Westinghouse electronic motor drives on three 30-year old Heald grinders resulting in: (1) improved quality of precision finishing; (2) vibration-free, stepless, speed control over a 20-to-one speed range; and (3) better working conditions. The electronic motor drive is a simple unit, consisting of an electronic rectifier to change alternating current to direct current, plus a d-c driving motor whose stepless speed is controlled by a potentiometer in the pushbutton station.

SYLVANIA NEWS

CONTRACTOR EDITION

AUGUST Published by SYLVANIA ELECTRIC PRODUCTS INC., Salem, Mass.

1945

TRANSLUCENT BASE ROTATES ON NEW CIRCULAR LAMPS

A new rotating base developed by Sylvania Electric appears destined to broaden the postwar markets for circular fluorescent lamps—just as the circular lamps are expected to widen the field of fluorescent lighting itself. With this new base, the pins can be set at any angle to the plane of the lamp.

FIXTURE DESIGN SIMPLIFIED

This feature will greatly simplify both the design of lighting fixtures and the installation of the circular lamps. Translucency of the base is another outstanding advantage, improving the appearance of the lamps.

First Sylvania circular lamp to use the new base will be the 12" diameter size. 8½" and 16" sizes will be introduced later.

Preliminary information on these lamps—not yet in commercial production—is available from Sylvania Electric as a guide in postwar planning.

NEW INSTANT-START LAMPS UNDAMPED BY HUMIDITY

Tube Coating Sheds Moisture, Assures Starting Under Adverse Conditions

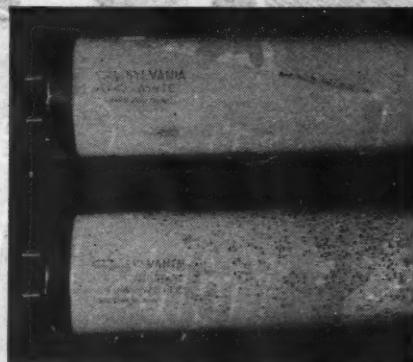
Instant starting of fluorescent lamps has now become entirely practicable—even under the high humidity conditions that once made such starting a questionable matter. Instant starting circuits have, of course, been known for some time, but a new Sylvania Electric development now assures their successful operation even under adverse conditions.

SPECIAL COATING DOES THE TRICK

Secret of the new lamps lies in an external coating that keeps the undesirable moisture film from forming—but *does not* affect light output of the lamp. The accompanying photo shows how effective this coating is. At top is a standard 40-watt, T-12 fluorescent lamp subjected to a fine spray of water vapor. Complete coverage is indicated by large drops on underside. Below is a new Sylvania

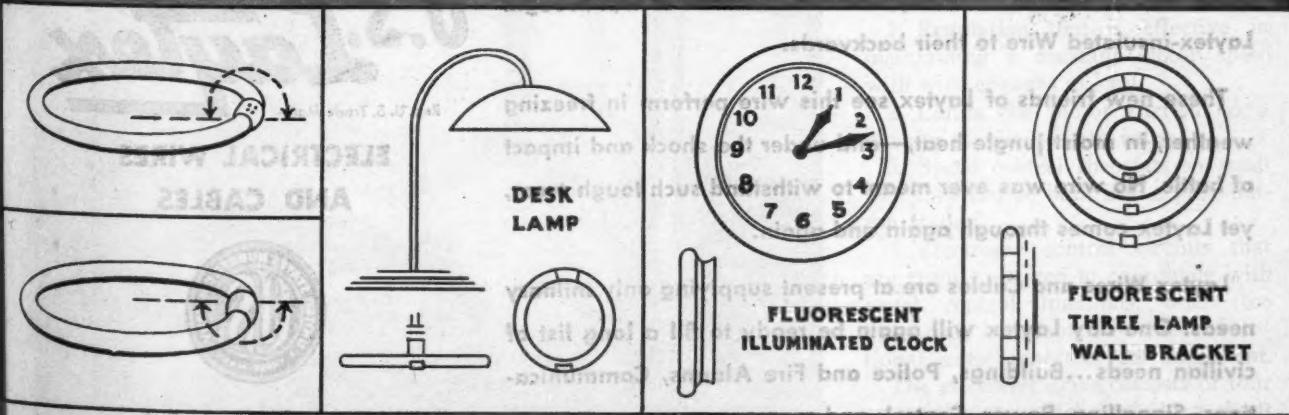
Instant-Start lamp subjected to same treatment. Note how special coating prohibits continuous film of water—moisture collects in tiny drops—each separated from the other by a completely dry area.

The new lamps, currently available



only in the 40-watt T-12 size, require a special ballast, details of which can be obtained from Sylvania Electric.

PREVIEW OF THE ROTATING-BASE CIRCULAR LAMP—AND SOME POSSIBLE USES



SYLVANIA ELECTRIC

MAKERS OF FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES



The chief is no different from the thousands of men all over the globe who never met electricity until the demands of war brought Laytex-insulated Wire to their backyards.

These new friends of Laytex see this wire perform in freezing weather, in moist jungle heat,—and under the shock and impact of battle. No wire was ever meant to withstand such tough wear, yet Laytex comes through again and again.

Laytex Wires and Cables are at present supplying only military needs. One day Laytex will again be ready to fill a long list of civilian needs...Buildings, Police and Fire Alarms, Communications, Signalling, Power, Control, and many more.

Rubber Insulation at Its Best

U.S. Laytex

Reg. U. S. Trade Mark

**ELECTRICAL WIRES
AND CABLES**



Serving Through Science

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.

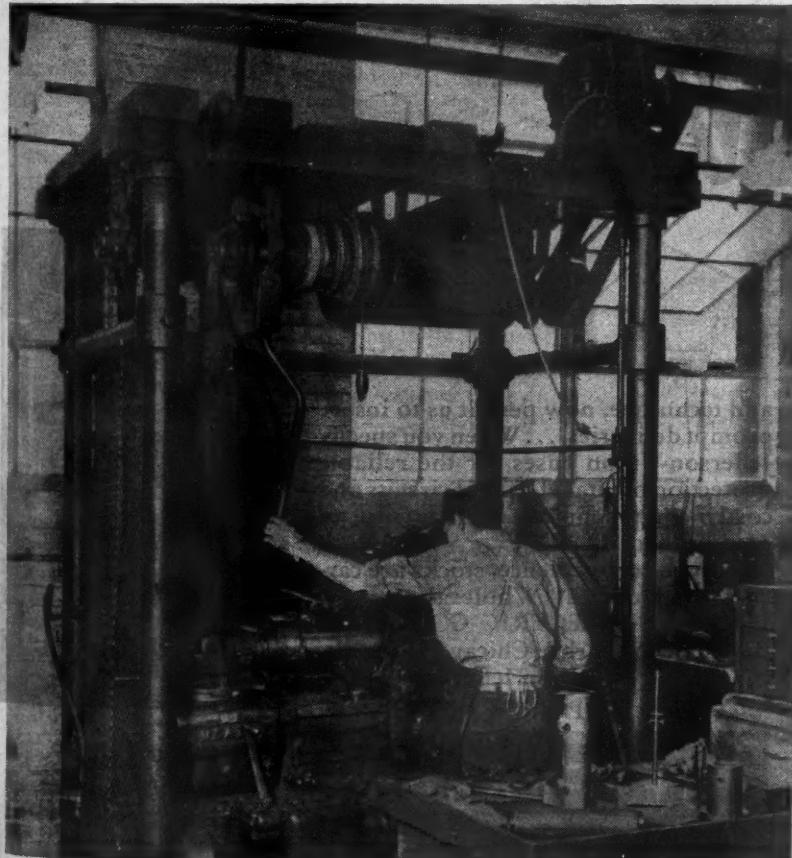
At the Axelson Manufacturing Company, problems in machining hardened pump liners were augmented by specifications which require a finished tolerance of .001 of an inch. The variation in liner sizes and materials used required grinding speeds over a wide, closely regulated stepless range in order to secure the desired tolerance and finish. This stepless quality in speed regulation permits the operator to choose just the right speed for size of hole, material to be finished and grade and grit of the wheel. Having exactly the right speed helps to eliminate vibration and chatter marks in the work and gives a straight, true, round hole, an ideal condition for the honing operations that follow, for unless a perfect hole is presented to the hone it is apt to follow any irregular conditions of the ground hole.

In addition to the advantage gained by providing stepless adjustable speed over a wide range, physical advantages were gained in the new layout of the machine. The three grinders were reset on a 35 degree angle with a saving in floor space of about one-third. Removal of all overhead pulleys, belts and shafting resulted in increased safety, and improved illumination.

The machinist can pre-set work



General view of machine room after changing to Westinghouse electronic motor drives. Conversion provided additional working space, entirely smooth speed over 20 to 1 stepless range, handy speed adjustment in pushbutton control, and more work from the old machines.



Designed 30 years ago and still going strong these Heald grinders were powered by typical belt-and-pulley drive of that era providing four speeds in definite steps.

speed either before starting work or change speed while the electric motor drive is running. Since the speed change can be made smoothly this can be done without danger of spoilage.

Electronic motor drives can be compared roughly to the common variable voltage adjustable voltage drive, since a wide speed range is obtained and it operates from an a-c power system. Here the similarity ceases, because the electronic motor drive has many advantages not found in conventional adjustable voltage drives; including:

1. Regulation that is effective in maintaining a constant motor speed with wide changes in load.
2. Limits the motor current to a definite maximum safe value.
3. Speed control rheostats so small that they can be built into a push-button station.
4. Electronic control circuits that are readily adapted to coordinate with usual control functions, often too minute to be adapted to the conventional motor-generator set equipment.

The electronic drive consists of four essential units which are (1) a shunt wound d-c motor, (2) a grid controlled thyratron rectifier together with the necessary auxiliary control tubes, (3) a separately mounted transformer and (4) a pushbutton control station with speed control rheostats.

ORDER YOUR FUSES NOW



The high standards set by the Army and Navy were no novelty at Jefferson Electric because Jefferson-Union Fuses had been made to unusually high standards of precision and accuracy for many, many years.

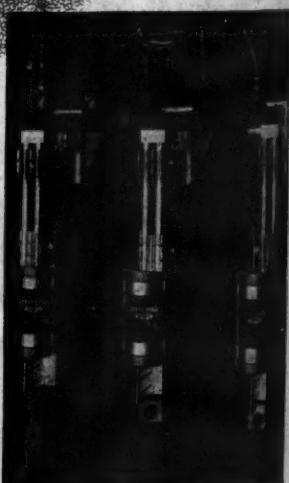
The extra hundreds of thousands of Jefferson-Union Fuses needed for ships, planes, signal corps trucks and in ordnance and essential war production plants required greater production capacity which with advanced methods

and technique, now permit us to insure prompt deliveries. . . . When you specify Jefferson-Union Fuses for the reliable protection of vital electrical circuits and costly equipment you can be sure of getting them.

For your convenience, stocks are carried by Electrical Wholesalers. . . . JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. In Canada: Canadian Jefferson Electric Co. Ltd., 384 Pape Ave., Toronto, Ont.

JEFFERSON UNION
Dependable
FUSES

JEFFERSON
ELECTRIC



DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index.

XRI

WIREMOLD INSTALLATION

(Outlet Extensions)

BUILDING CONSTRUCTION:

Fireproof construction; pan formed slabs; metal lath and plaster on ceilings; acoustical treatment on plaster. Columns 20'-0" on center both ways form "bays" which are outlined by heavy beams projecting below ceiling line at the column lines.

NATURE OF JOB:

Each "bay" has two ceiling outlets properly centered. From each existing ceiling outlet, which is flush in the concrete, extend both ways to two new outlets, making four per bay, with the two existing outlets capped.

JOB CONDITIONS:

Quantity Installation—Floor area was slightly congested; space partly occupied. Ladders were used on 12'-0" ceiling height. Since existing outlets occurred in beams formed by the pans, the new outlets were extended along the same beams and had to be fastened with expansion shields and bolts. If they had been off the beams, toggle bolts could have been used.

It was difficult to snap lines because of the downward projection of the beams and only a limited area could be laid out at one time.

The extension to the existing outlets was made with $\frac{3}{8}$ " extensions and a special strap as the existing box is up $1\frac{3}{4}$ in. due to plaster and acoustic treatment. The extension box is of the large size so that it sandwiches the acoustic and makes a finished job. The longest extension from existing outlets was 5'-0" from center to center of new outlet and no supporting clips were used. This is the maximum length at which this could be done.

The new outlets were fastened with one $1/4$ -20 expansion shield and bolt through the center of the no-bolt stud.

LABOR ANALYSIS:

If space was unoccupied and not congested, deduct 10 percent from all units.

If space was very congested add 15 percent to all units.

If outlets occurred off the beams and toggle bolts could be used instead of expansion shields, outlet unit would be 0.55 mh. each instead of 0.75 mh.,

LABOR DATA:—FOR A TYPICAL BAY

Material	Man-Hours	
	Unit	Total
2 Wiremold #5737A extension boxes	*0.35 ea.	0.70
2 Special straps		
2 3/8" nipples, couplings, etc.		
2 Wiremold #5736 blank covers		
20' Wiremold #500 raceway	**3.80 C'	0.76
60' #12 type R wire	9.00 M'	0.54
4 Wiremold #5738A fixture boxes	0.75 ea.	3.00
4 No-bolt fixture studs		
4 1/4"-20 A.J. & 2 1/2" R.H. bolts		
Misc. Tape, solder, etc.		
TOTAL MAN HOURS PER BAY		5.00

Note:

*Does not include removing existing fixture.

**If supporting clips had been used, unit for Wiremold Installation

would increase to 7.30 man hours per 100 feet.

and unit for installing No. 500 raceway would be 4.60 mh. instead of 7.30 mh. per 100 feet. If ceiling was not plastered and treated with acoustic, deduct 10 percent from all raceway and outlet units.

LABOR CLASSIFICATION:

One "E" man; Two "C" men used on the job.

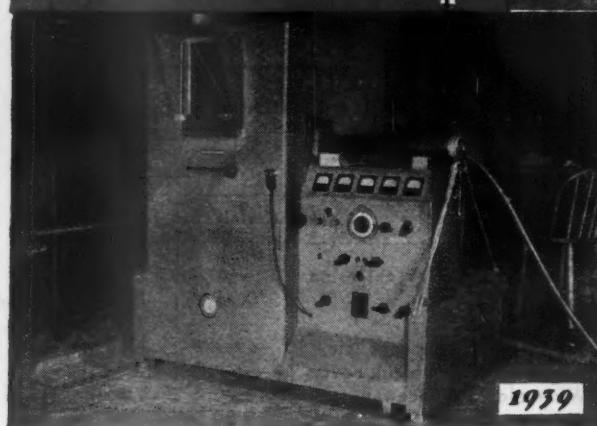
The types of available labor are rated A-B-C-D-E, with the units based upon average use of B labor. In general, an A man will run the job assisted by B and C labor, which will average class B. In abnormal times the general labor classification will fall to D and E for new labor being employed to fortify the regular personnel. It must be noted that the classification applies only to rate of time and not to knowledge or mechanical ability. A splendid mechanic may be rated C from a rate of time classification.

Labor Classification	Changes in Standard Units
A	deduct 10%
B	no change
C	add 10%
D	add 20%
E	add 30%

The labor classification shown in the estimating data above shows the labor classification rating of the mechanics who performed the particular job so that adjustment can be made on the type of labor available.

Data From L. W. Witz, Continental Electrical Construction Co., Chicago, Ill.

3 X-Ray Outfits



NOW HELP TO MAINTAIN SIMPLEX

Quality

Three X-ray outfits at Simplex are used for routine tests and inspection of insulation and cable cores to make sure that Simplex quality is maintained. They also enable us to investigate hidden, internal causes of electrical weaknesses such as air pockets and foreign particles in insulations. They are a valuable aid in developing cables specially designed

to meet unusual service requirements.

Simplex was among the first to use X-ray inspections as an aid in the design of electric cables and as a check on manufacturing processes. The first installation in 1939 was so successful that a second outfit was added in 1942 and a third in 1944. All three are now helping to maintain Simplex quality.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.



Simplex
WIRES and CABLES

Elect

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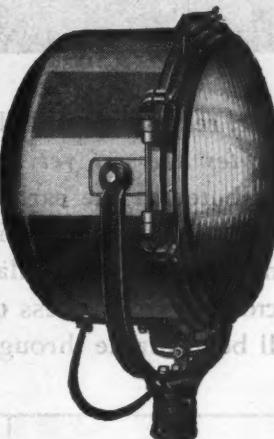
Electri

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

EQUIPMENT NEWS

Floodlight

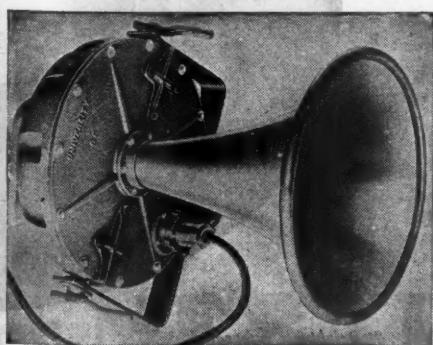
This floodlight unit was principally designed for airport landing field lighting but it can be used for illuminating any large area. It is built to Army-Navy specifications and obtainable with a variety of spread lenses. Can be used singly or in banks of two or more by overlapping of the beams, providing high intensity illumination. The housing is a one piece aluminum alloy casting—dust-tight and weather-proof. Main reflector is 25 inches in diameter. An auxiliary spherical reflector is provided in front of lamp which redirects spill light to the main reflector. Two-pole terminal block is provided in the lower interior of housing. It uses 1500 watt, 32 volt, T-24 bulb or 3000 watt 32 volt T-32 bulb. Revere Electric Mfg. Co., 6017 Broadway, Chicago 40, Ill.



REVERE FLOODLIGHT

Loudspeaker

This new unit, Model B-6, is a high powered directional loudspeaker for long range speech projection through high noise levels—approximately one mile over open country and two miles over water. Primarily designed for speech reproduction, it has a frequency range of 300 to 5000 cycles per second and handles 150 watts of audio power. Water-proof construction permits continuous outdoor exposure and speaker may be submerged in salt water without damage. Six driver units power the speaker. These are connected in series with a high impedance reactor shunted across each coil. A collapsible tripod type of stand is available for mounting. University Laboratories, 225 Varick Street, New York 14, N. Y.



UNIVERSITY LOUDSPEAKER

Ultra Violet Fixture

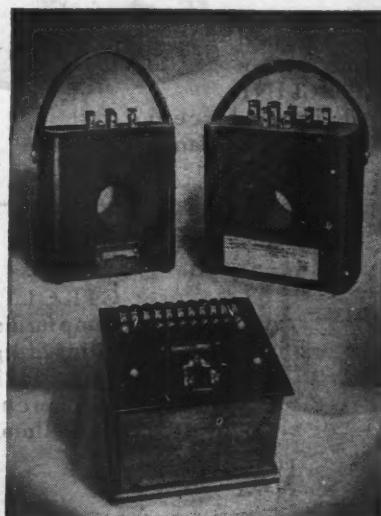
Equipped with a highly concentrating Alzak reflector, this new fixture, known as "Barrier Germ-Killing Light", can be arranged to curtain-off an entire area against outside germs. Over food counters, the ultra violet beam can be directed on exposed food to prevent settling of air-carried germs. Offices, and rooms in the home can be curtained against outside germs. The new fixture is available in two sizes, and is for use with 15 watt and 30 watt germicidal lamps. The Edwin F. Guth Co., 6215 Washington Ave., St. Louis 3, Mo.



GUTH BARRIER

Portable Current Transformer

A new line of portable current transformers, Types JP-2, -3 and -4, has been announced. All three types may be obtained as multi-range units. Type JP-2 is also available as a single-range unit. The JP-2 and -3 units meet the accuracy requirements of the ASA 0.3 accuracy class with burdens B-0.1, -0.2, and -0.5 at 60 cycles. Both units, of through-window type construction, are suitable for laboratory standard work or for testing work in the field. The JP-2 is not supplied with a primary winding, but there is a hole in the core through which a cable or conductor can be passed. There is a tapped secondary winding, and the terminals on top of the case are all secondary terminals. The JP-3 unit is designed with a combination of wound-primary and through-primary construction. Ratings of 100 amperes and below are obtained by a wound-primary with the terminals on the top of the transformer. The Type JP-4 is designed for application as a laboratory standard. It is of wound-primary construction with taps in the primary coil for the different ratios. General Electric Co., Schenectady 5, N. Y.

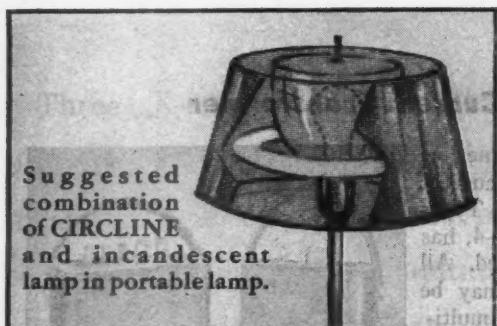


G-E TRANSFORMER

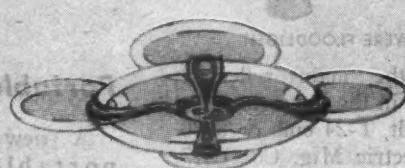
NOW! More Facts G-E CIRCLINE

Development of circular fluorescent lamps by General Electric Lamp Research opens up many opportunities for new lighting business in all the major lighting markets. Here, for the first time, is the technical data on the 12-inch G-E CIRCLINE Lamp. Data on two additional circular F lamps (8½" and 16" outside dia-

meter, respectively) will be announced later. Samples are not yet available but will be distributed at the earliest possible moment. Quantity production will begin as soon as conditions permit. Ballasts, starters and connectors are in process of development. Data will be available through the usual channels.



Suggested combination of CIRCLINE and incandescent lamp in portable lamp.



Idea for ceiling fixture for homes and for stores, theaters and other commercial applications.

**TYPICAL
APPLICATIONS
OF THE
NEW G-E
CIRCLINE**



CIRCLINE
Lamp furnishes
diffused light-
ing in this idea
for machine
tool illumina-
tion.



CIRCLINE lamps
form directional
promenade for
stores in this suggestion.

APPROXIMATE DATA FOR 12" G-E CIRCLINE LAMP

Lamp Watts	32 Watts
Outside Diameter of Circle	12" \pm ¼"
Diameter of Tube	T-10 (1¼")
Lamp Amperes (operating)	0.42—0.43 Amps
Lamp Volts (operating)	84-86 Volts
Type of Base	4 Pin { 2 pins for each end of tube to provide for cathode preheat)
Light Output (estimate) (White)	1600 Lumens
Brightness—Foot-lamberts (estimate)	2040 Foot-lamberts
Candles/sq. in. (estimate)*	4.5 Candles/sq. in.
Early test data indicate a rated life corresponding to the standard 40-watt T-12 fluorescent lamp.	

* Brightness integrated across the tube diameter in the center of the tube.

about the New Fluorescent Lamp



SAFETY SWITCH WITH "CHARMATIC" CONTACTS

Size for every switch job

Switch contacts, like all electrical contacts, are subject to wear and deterioration. The new "Charmatic" contacts are designed to withstand many times the normal wear of ordinary contacts. They are made of a special metal which is extremely hard and wear-resistant. The contacts are made in two sizes, one for each type of switch. The "Charmatic" contacts are available in all standard sizes and types of switches.

The "Charmatic" contacts are made of a special metal which is extremely hard and wear-resistant. The contacts are made in two sizes, one for each type of switch. The "Charmatic" contacts are available in all standard sizes and types of switches.



BUY WAR BONDS AND HOLD THEM

G-E LAMPS

GENERAL ELECTRIC



BOX 111 RIVER AMMEX DETROIT
35 MICHIGAN Building Electric

Legionnaires



Vacu-Break SAFETY SWITCH with "CLAMPMATIC" CONTACTS
Sizes for Every Switch Job

For greater safety and dependability, longer life and lower upkeep costs, leading plants the country over depend on BullDog Vacu-Break Safety Switches.

Designed in a wide variety of sizes and types with capacities ranging from 30 to 1200 amperes, standard models of this famous switch are available for every industrial requirement.

No other safety switch has "Clamp-

matic" contacts, tight as a bolted connection in the ON position, to reduce heating—the Vacu-Break principle of arc suffocation to snuff out destructive arcs as quickly as they form—new simplified operating mechanism in modern streamlined cabinet.

Talk to expert BullDog field engineers about the electrical distribution problems in your plant. Or write us for literature.

BUY WAR BONDS WAR BONDS

BOX 177, R. PK. ANNEX, DETROIT
32, MICHIGAN. BullDog Electric
Products of Canada, Ltd., Toronto.
Field Offices in All Principal Cities.

BULLDOG

ELECTRIC PRODUCTS COMPANY



Alco Manufacturing of

Also Manufacturers of
**SaToFuse Panelboards—Switchboards—
Circuit Master Breakers—Universal Trol-E-
Duct, for flexible lighting—Industrial
Trol-E-Duct, for movable "loads"—BUS-
tribution DUCT, for "Plug-In" Power.**

Welder

The new P&H square frame welder, Model WA-300, provides a welding service range rating of from 60 to 375 amperes. It has the simple design of the smaller square frame welder and also retains the two-part construction, single heat control, visual current calibration, and adaptability to parallel operation where higher amperage is desired. Some of the new features of this welder are weatherproof construction, polarity reversing switch, removable stator, and overload protection both for contacts and for the new low voltage magnetic starter. Harnischfeger Corporation, Welding Division, Milwaukee 14, Wis.



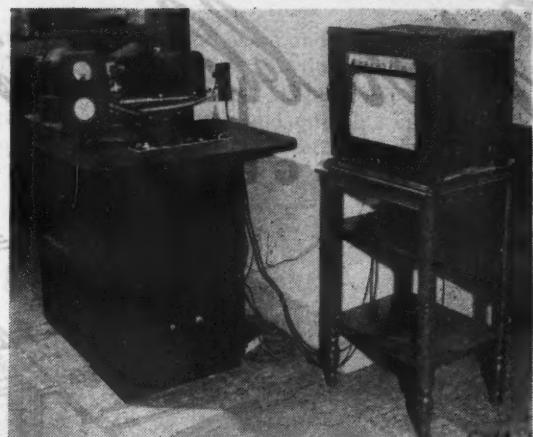
HARNISCHFEGER WELDER

Portable Infra-Red Equipment

A new line of portable infra-red models for industry and service shops to handle multiple baking, drying, dehydrating and preheating operations has been announced. Model No. 62-247 illustrated, provides a uniform radiation for approximately 500 square inches. The group of four models provide radiation coverage ranging from 275 square inches on the smallest to 2000 square inches on the largest. The reflector assemblies on all models are attached to the upright support and base by an arm equipped with a rotating swivel device which permits radiation in any direction. The majority of the models are wired to accommodate lamps ranging from 125 watt to 500 watt, 120 volt. The Fostoria Pressed Steel Corp. Fostoria, Ohio.



FOSTORIA INFRA-RED EQUIPMENT



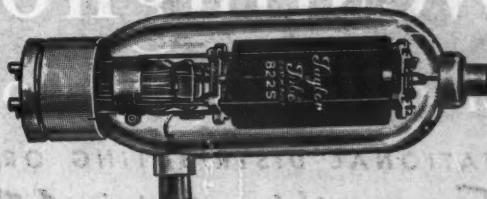
X-RAY SPECTROMETER

X-Ray Spectrometer

The Norelco Geiger-Counter X-Ray Spectrometer draws analytical curves automatically on the strip-chart recorder. A small synchronous motor (through gear and clutch arrangement) slowly moves the Geiger-Muller tube over the graduated quadrant. The tube then picks up X-radiation and the intensities create a "hill and valley" curve on the chart. X-Ray diffraction has been used in research fields for many years but this equipment has been simplified and perfected to make it practical for industrial control and analysis. With the addition of the automatic recorder, it is claimed that the X-ray Spectrometer is capable of greater accomplishments in the fields of food, drugs, chemicals, metals and plastics. North American Philips Company, 100 East 42d Street, New York 17, N. Y.

High Power Triode Tube

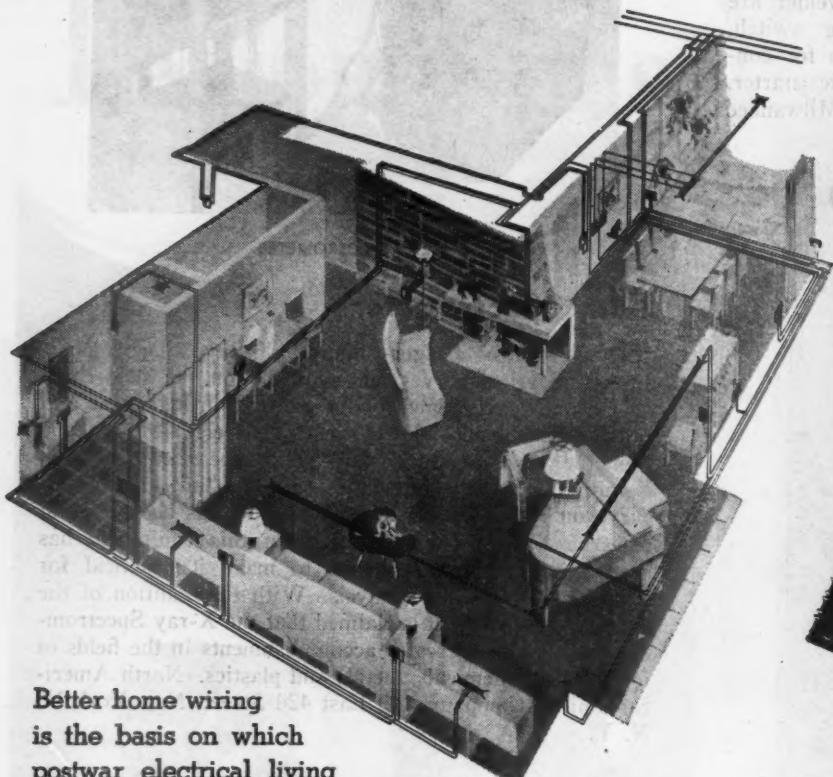
A new high power 822-S triode tube with a frequency application limitation of 30 MC has been announced. Designed for peak performance in all RF services, diathermy and Class B audio, the tube is usable in induction heating applications as well. It will furnish up to 1 kw. of audio output in Class B (in pairs) at 3000 volts and .5 amperes on the plates or as low as 400 watts audio in Class B with 1500 volts at .390 amperes. As a Class C amplifier (telephone) its maximum ratings include a power output of 405 watts with 2000 volts at .250 amperes on the plate and 1.37 watts driving power. Under Typical Class C (telegraphy) ratings the tube will provide 600 watts output with 2500 volts at .3 amperes on the plate with a driving power of 17 watts. Electrical characteristics are: filament—10 volts at 4 amperes; amplification factor—30; plate dissipation—200 watts; interelectrode capacities—grid—plate; 13.5 mmf; grid—filament; 8.5 mmf; plate 0 filament; 2.1 mmf. Taylor Tubes, Inc., 2312 Wabansia Avenue, Chicago, Ill.



TAYLOR TRIODE TUBE

Your Blueprint!

FOR BIGGER POSTWAR PROFITS



Better home wiring is the basis on which postwar electrical living is blueprinted. To the electrical contractor this means satisfied customers . . . and bigger profits.

When the home owner "wires ahead" to enjoy the full benefits of electrical living, he expects the wiring installation to be fully adequate for his present needs—and for the years ahead. This means enough circuits and convenience outlets, wire of ample size, modern circuit protection and quality wiring devices and workmanship.

Here is where Wesco can help you. You can depend on your local Wesco Office to supply all the materials you need for better wiring and to stand ready to give you deliveries in a hurry.



Westinghouse

Electric Supply Company

NATIONAL DISTRIBUTING ORGANIZATION
For everything electrical  Wesco



Home wiring requires the "know-how" and engineering that you will find completely and specifically covered in the new Westinghouse Home Wiring Handbook. With its practical aid you can quickly and accurately determine the number and size of conductors for each of four popular house groups, set up complete circuit protection, locate control centers, and complete even to minimum wiring, floor plans, formulae and symbols. To get your copy, simply fill in the coupon below and mail to Wesco.

Westinghouse Electric Supply Co.
Box 25, Wall Street Station—40 Wall Street,
New York 5, New York

Gentlemen: Please send me the new Westinghouse Home Wiring Handbook. I enclose \$1 in full payment.

Name: _____
Company: _____
Address: _____
City and Zone: _____
State: _____

"Change-over" Rectifier

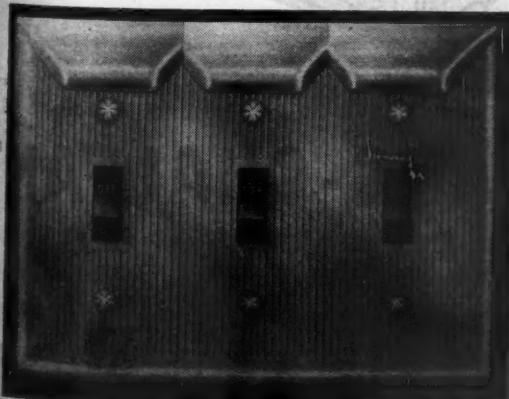
This rectifier unit, Type 50, eliminates the need for re-motoring d-c equipment in cases where the commercial-current source is changed over from direct to alternating current, or where d-c equipment is moved into a-c areas. It has been used for operation of d-c motors of up to 2 hp. The unit is also used for operating magnetic chucks, electro-magnets, solenoids, relays, signal systems, and other d-c equipment. It operates on 110 or 220 volt, 50-60 cycle a-c and delivers 12 amp. full-wave pulsating d-c at approximately input voltage. It uses four hot-cathode mercury-vapor tubes of the "shielded-cathode" type in a straight bridge circuit, with no transformer except a small 104 watt unit for heating the tube cathodes. Voltage drop in the arc of each tube is 5 to 8 volts, tubes are rated at 2000 hours at 12 amps., provided surge current does not exceed 24 amps. The rectifier is 14½ inches high, 17 inches wide and 6 inches deep. Housing is of steel and is arranged for wall mounting. Fuse blocks in both input and output circuits provide terminals for power connections; conduit openings in the housing are ½ inches in diameter. Automatic Electric Company, 1033 West Van Buren Street, Chicago 7, Ill.



AUTOMATIC RECTIFIER

Lighted Wall Switch Plate

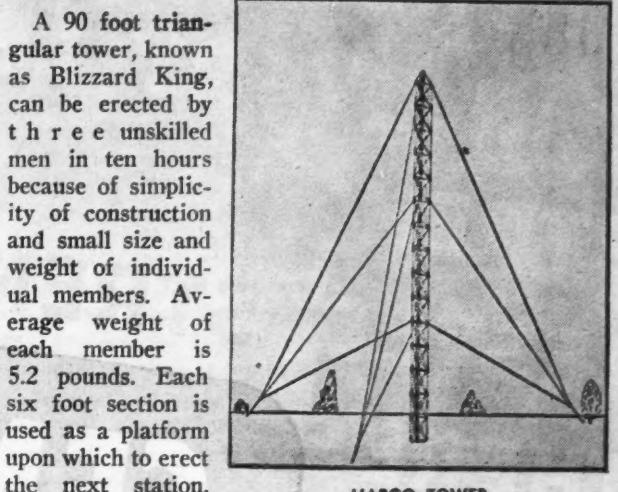
Panels of two, three or more toggle switches can be equipped with the new LumiNite electrically lighted wall switch plate. A tiny soft glow light, located behind the plastic lobe at the top of the plate, comes on automatically when room lights are turned out and remains off whenever room lights are burning. It makes the switch easy to locate in the dark and serves as a safety or pilot light at night. It is made to accommodate multiple switch panels built up of matching sectional plates—right hand, left hand and



ASSOCIATED PROJECTS PLATE

center sections sized to match and fit. Unit fits any standard switch and can be used in three and four way switch arrangements. Installation is made by connecting two wires to the terminals found on the switch. Associated Projects Co., 80 East Long Street, Columbus 15, Ohio.

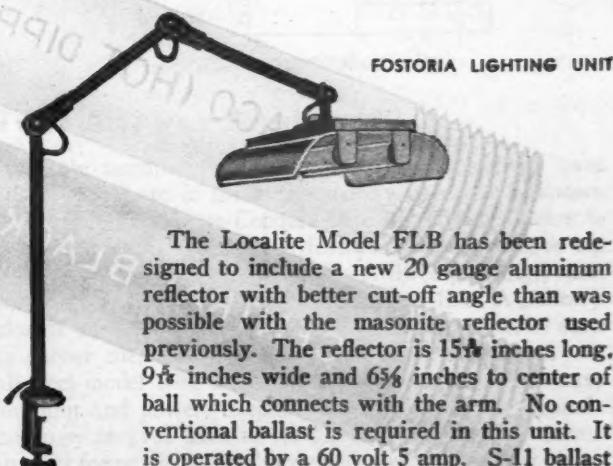
Triangular Tower



HARCO TOWER

A 90 foot triangular tower, known as Blizzard King, can be erected by three unskilled men in ten hours because of simplicity of construction and small size and weight of individual members. Average weight of each member is 5.2 pounds. Each six foot section is used as a platform upon which to erect the next station. The members used consist of sleeve connections, tubular corner posts, horizontal steel channel members and diagonal flats. After any one section is completed and the ladder installed, the three corner posts of the next section are dropped into place. The sleeve connections are slipped over the top of the corner posts and the horizontal channels are bolted in place and followed by the diagonals. The ladder is then installed and the operation repeated. The tower forms a safety basket around the ladder providing a safe and easy means of ascent. Harco Steel Construction Co., Inc., 1180 East Broad Street, Elizabeth 4, N. J.

Fluorescent Lighting Unit



The Localite Model FLB has been redesigned to include a new 20 gauge aluminum reflector with better cut-off angle than was possible with the masonite reflector used previously. The reflector is 15½ inches long, 9½ inches wide and 6½ inches to center of ball which connects with the arm. No conventional ballast is required in this unit. It is operated by a 60 volt 5 amp. S-11 ballast lamp. A variety of standard Localite arms and bases are available to use with the FLB reflector. FLB operates on 110-125 volts, either a-c or d-c. It utilizes two 14 watt fluorescent lamps. The Fostoria Pressed Steel Corporation, Fostoria, Ohio.

STRENGTH IN EVER
TESTED STRENGTH IN EVER
THERE'S TESTED STRENGTH
IN EVERY LENGTH. THERE'S
STRENGTH IN EVER
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THERE'S TESTED STRENGTH
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STRENGTH IN EVER

CENTRAL RIGID STEEL CONDUIT



SPANG-CHALFANT

Division of The National Supply Company

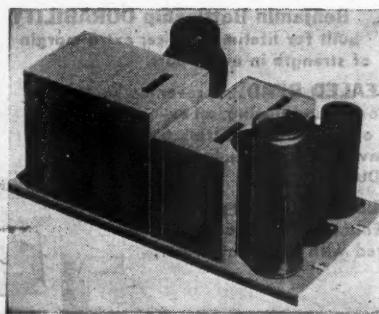
General Sales Office: Grant Building, Pittsburgh 30, Pa.
District Offices and Sales Representatives in Principal Cities

Cold Setting Plastic

A new cold setting plastic, known as Cardolite 5616, is for use as a filling material for junction boxes, stuffing boxes, potheads and similar void spaces encountered in electrical work. This liquid resin is mixed with Irvington 5612 setting agent prior to use. Approximately four hours after mixing, the two ingredients will gel at room temperature to the point where flow is no longer possible and after several days, the end product is a tough rubbery mass which will not flow under heat nor become brittle in the cold. The set compound is insoluble in water, oil, acids and alkalies. Although it will adhere to metal, it can be stripped away to allow repairs to terminals and cable strips. The Irvington Varnish & Insulator Company, Irvington 11, N. J.

Rectifiers

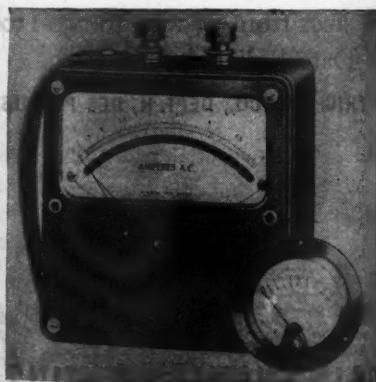
A new series of rectifiers has been announced. Type 201-A is designed to furnish filament and plate currents to line amplifiers. It delivers 275 volts at 75 m.a./6.3 volt at 8 amp. Length is 10-9/32 inch, width 5-7/32 inch, height 6 $\frac{1}{2}$ inches. Type 201-B is similar to 201-A except an additional stage of filter is included. This unit is designated to supply filament and plate power to quiet pre-amplifiers. The Langevin Company, Inc., 37-West 65th Street, New York 23, N. Y.



LANGEVIN RECTIFIER

Instruments

This line of a-c electrical measuring instruments can now be furnished with special forms of compensation to retain their accuracy over the broad frequency range of from 25 to 3000 cycles. These instruments have been used by the armed forces, and it is said that they will prove highly advantageous to industry in those applications using power frequencies above 60 cycles, with the smaller associated transformers, higher speed motors and simpler rectifier filter systems. Not only do they afford broad measure-



WESTON MEASURING INSTRUMENT

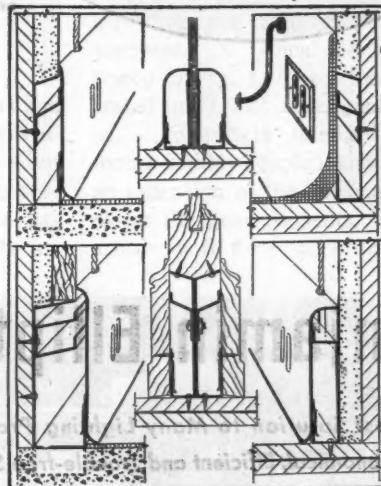
ment flexibility, but also the dependability of the basic moving iron vane and dynamometer type instruments. These frequency compensated instruments are furnished as ammeters, voltmeters and wattmeters in both the portable and switchboard types; flat compensated up to 1000, 2000 and 3000 cycles. Weston Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, N. J.

Shallow-Bowl Reflector



QUADRANGLE REFLECTOR

This porcelain enameled reflector and galvanized steel bracket is designed for wide spread lighting and has many uses in suburban and farm areas—driveways, garage exteriors and yard lighting. Also suitable for the protective lighting of industrial plants. Reflector is steel, porcelain enameled green outside, white inside, complete with porcelain socket, rubber bushed wire way, two lengths of wire, a galvanized steel bracket and mounting screws. It can be mounted on pole, tree or wall of any building. Quadrangle Manufacturing Co., 32 So. Peoria Street, Chicago, Ill.



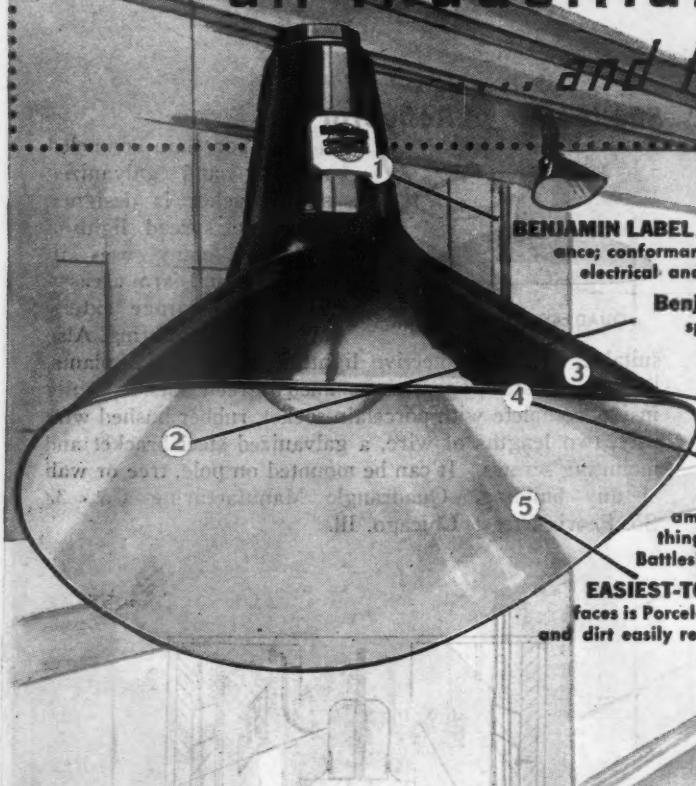
ERECTO-LOXTITE-CONDUIT BASE

Twin Raceway Baseboard

Ample facilities for light, power and telephone have been worked out in the twin raceway baseboards, known as the Erecto-Loxtite-Conduit base assemblies. There is a general utility type, which features a five-inch cove top and bottom sanitary steel closure. A three-inch high base, which can be erected in front of the plaster line. A sanitary closure can be formed by using any six-inch material such as rubber tile, ceramic tile, asphalt tile or linoleum. An all steel model with six-inch closure, with three raceways for light and power, telephone and inter-office communication system. A back to back arrangement which forms support for partitions and provides wire carrying facilities. A five-inch development for either new buildings or renovating old ones. All metal fronts are ten feet in length and have duplex knockouts on 40-inch centers. Charles E. Barnes & Son, 4320-22 Osage Avenue, Philadelphia 4, Pa.

One of the Most Popular of all Industrial Lighting Units

... and for good reason!



BENJAMIN LABEL... guarantees satisfactory performance; conformance to all recognized illumination, electrical and mechanical codes and standards.

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Benjamin Battleship DURABILITY built for lifetime service; extra margin of strength in every part.

SEALED BEAD... prevents corrosion and rusting, an example of the many "little things" involved in Benjamin Battleship Durability.

EASIEST-TO-CLEAN of all light reflecting surfaces is Porcelain Enamel; cannot corrode; grime and dirt easily removed with soap and water.



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A Lifetime of Economical, Efficient and Trouble-free Service!

Thousands of industrial plants have found in the Benjamin Elliptical Angle Unit a most satisfactory and economical solution to certain special lighting problems quite commonly found in Industry. For this unit is especially designed for the lighting of many locations where overhead obstructions make overhead illumination difficult or unsatisfactory . . .

Specify
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for the lighting of locations where high ceilings may require special units for adequate illumination of the vertical surfaces . . . and for the localized lighting of many vertical areas where fairly large areas are involved, etc.

For complete details on these units (available in a wide range of sizes from 75 watt to 750-1500 watt), write for free Data Bulletin. .

BENJAMIN ELECTRIC MFG. CO., DEPT. H, DES PLAINES, ILLINOIS

Elliptical Angle
PORCELAIN ENAMEL LIGHTING UNITS
Distributed Exclusively through Electrical Wholesalers

INDUSTRIAL ELECTRIFICATION

ENGINEERING • INSTALLATION • MAINTENANCE

Selection and Application of Gearmotors—I

The gearmotor—a simple, compact, packaged power drive—has numerous industrial applications. This initial article reviews the types and classifications available.

THE principal advantage of the gearmotor lies in the fact that it affords a compact, streamlined, packaged power drive, available in a wide range of output speeds which can be purchased and installed with a minimum of engineering consideration. Selections for almost any type of service or duty can readily and consistently be made because of the standardization among manufacturers on ratings and service classifications. These factors have been largely responsible for its wide acceptance.

Historically the gearmotor appeared on the scene as a standardized unitary drive during the early thirties. There had been earlier applications of integral motor and gear constructions but these were generally limited to and engineered for special requirements where space was a paramount consideration. The desire for a unitary drive had already been manifested by the advent of the back geared drive motor which consisted of spur gearing mounted on a common base plate with the motor, and was offered in a rather limited choice of speeds.

The flat-belt, V-belt, and the chain drive have characteristics which still make them desirable as power transmitting equipment on certain applications. However, they lack the compact, streamlined features which have been responsible for the rapid progress of the gearmotor in the last ten years,

*Chairman, Tooth Form Committee, AGMA

**Chairman, Helical and Herringbone Gear Committee, AGMA

By W. P. Schmitter* and H. W. Kayser**
Chief Engineer and Development Engineer

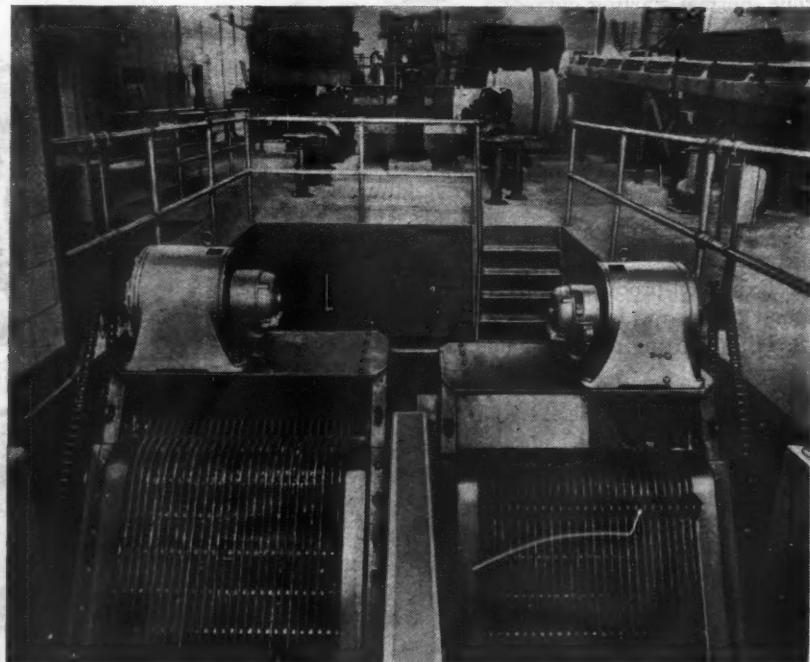
The Falk Corporation
Milwaukee, Wis.

particularly in the small and medium horsepower field.

Types Available

While mechanical constructions and gear designs vary among the individual gearmotor manufacturers, a division into two fundamental types is possible. The *Integral* gearmotor consists of a round frame motor directly at-

tached to the transmission housing, affording the greatest possible compactness. A typical design is illustrated in Fig. 1. The *Allmotor* (illustrated in Fig. 2) type involves the use of a completely standard horizontal motor flexibly coupled, and mounted on an extension of the housing which encloses the gear elements. It requires a little more floor space than the Inte-



Integral gearmotors of triple reduction type drive self-cleaning, coarse-tooth screens in a sewage treatment plant. Units are rated 3 hp. at 7.5 rpm. output speed.



Fig. 1—Integral type gearmotor with a 1750 rpm motor bolted directly to gear housing provides a compact unit. Ratio of this double-reduction unit is 6.5 to 1.

gral type but offsetting this is the fact that it accommodates standard horizontal motors and retains certain of the unique features of separate speed reducer design.

Electrical Characteristics

The determination of the electrical motor characteristics to be specified is dictated by the same considerations as in the case of individual motor selection. These factors include starting torque, speed regulation, power factor, etc. For the Integral gearmotor the squirrel cage is the most popular, although the following types are regularly furnished:

1. Standard squirrel cage—normal torque, normal starting current.
2. Squirrel cage—normal starting torque, low starting current.
3. Squirrel cage—high starting torque, low starting current.
4. Slip ring wound rotor.
5. Totally enclosed fan cooled, standard squirrel cage.
6. Splash proof standard squirrel cage.
7. Explosion-proof standard squirrel cage.
8. High starting torque, double cage motor.

It is obvious that there are no limitations whatsoever in the choice of motors for the Allmotor type. A change can be made from one type to another with ease; the motor may be sleeve or ball bearing, d-c or a-c, and of any make.

Standardized Speeds

To suit the requirements of the driven equipment, gearmotor manufacturers offer a wide choice of available output speeds. These have been stand-

ardized by the American Gear Manufacturers Association and the National Electric Manufacturers' Association on the basis of a preferred number series of 1.225. Thus it is always possible to obtain a standard speed (see Table I) within approximately ten percent of the theoretical requirement. Special ratios can only be furnished with considerably longer deliveries.

Gear Constructions

Ordinarily the output and motor shafts are parallel, the speed reduction being obtained either by simple gear trains or planetary arrangements. The single helical type of gear is desirable in either case. It offers the advantages of the smooth power transmission obtained by the simultaneous presence of all phases of tooth engagement while retaining fixed axial positioning of all the gear elements.

Since the gearmotor must cover a speed range extending down to approximately four rpm., single, double, and triple trains of gears are ordinarily required. Manufacturers of planetary gearmotors usually include a compound. Fig. 3 shows a simple train

TABLE I		
Standard Output Speeds—rpm		
1430	190	25.0
1170	155	20.0
950	125	16.5
780	100	13.5
640	84	11.0
520	68	9.0
420	56	7.5
350	45	6.0
280	37	5.0
230	30	4.0

Note: These output speeds for concentric and parallel shaft gearmotors are based on 1750 rpm. motor operating speeds.

Example: $\frac{1750}{1.225} = 1430$

$$\frac{1430}{1.225} = 1170, \text{ etc.}$$

The above list of speeds may be applied to 25 or 50 cycle gearmotors when using motors of 1500 rpm synchronous speed, if an assumed motor operating speed of 1430 rpm. is used.

Likewise, this table may be applied to 60 cycle gearmotors when using motors of 1200 rpm synchronous speed, if an assumed motor operating speed of 1165 rpm is used.

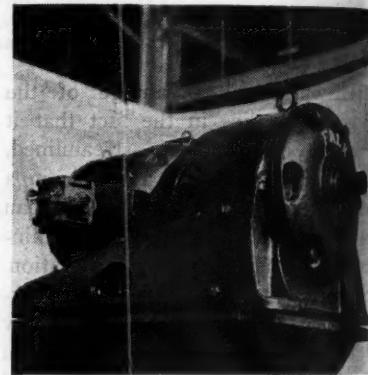
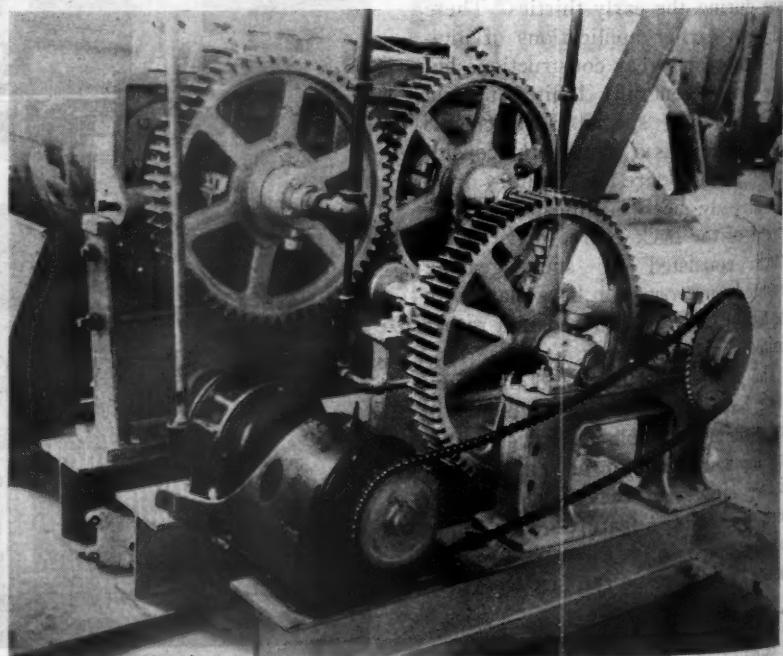


Fig. 2—Allmotor type gearmotor unit has as part of the gear housing a base which accommodates any standard make of motor giving outstanding versatility.



Allmotor type gearmotor chain-drives a mixer in a food processing plant. Unit is a double reduction type with a 1 hp. motor and 45 rpm output speed.

helical geared triple reduction unit and Fig. 4 a double reduction planetary gearmotor.

When a right angle drive is desired worm type gearmotors are sometimes considered. If the ratio is high, allowance must be made for the lower efficiency and the horsepower must be specified on the basis of the required output capacity.

Vertical Gearmotors

Standard horizontal gearmotors may be mounted on the floor, ceiling, wall, or at an angle, but the unusual application sometimes entails modifications at the factory to insure adequate lubrication.

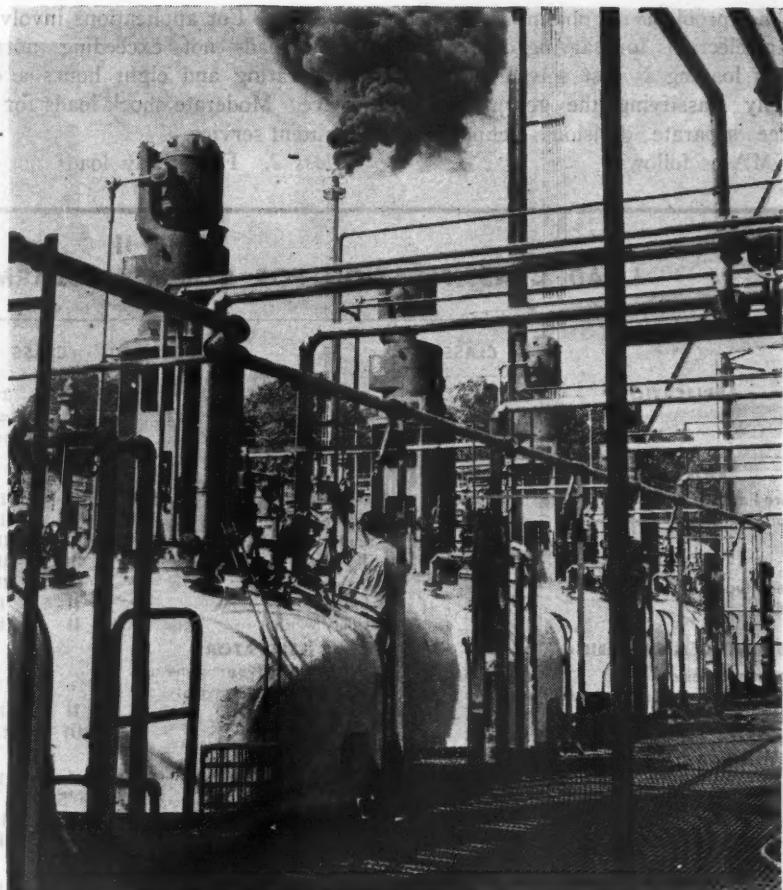
The vertical gearmotor is designed with a positive sealing arrangement at the low speed shaft and means for the continuous lubrication of the vertical revolving elements. This is usually accomplished by providing an oil sump below the gears and employing a pump to convey the lubricant to the top of the gear chamber from which it is distributed to the gear meshes and to the bearings. Fig. 5 illustrates a flange mounted vertical gearmotor of the Integral type. It is also available in the Allmotor construction.

Uniform Rating Used

The Standard Practice of the American Gear Manufacturers Association for the Rating of Concentric and Parallel Shaft Gearmotors cover limiting stresses for gears, shafts, and bearings. It has almost universal acceptance among the gearmotor manufacturers. Fig. 6 shows the ratings of the component elements of a medium size gearmotor using the formula, recommended by AGMA. The final or published rating is based upon that of the weakest member for each condition of speed and power. Properly selected and applied, such types of gear distress as pitting, scuffing, and abrasive wear of the tooth contours, breakage of teeth or shafts, and premature bearing failure will be avoided with gearmotors rated by this method.

The loading to be sustained by the gears consists of (a) the transmitted applied load, (b) the self-generated increment load which arises from the minute inherent in accuracies of the gears, and (c) the reactionary loads produced from the recurrent storage and release of potential energy in the system, generally referred to as shock. The life of a given gear is influenced by the magnitude and frequency of such impulses. The mere horsepower specification does not account for them since it is only a measure of average power without distinction between the peaks which produce that average.

The electric motor is not affected by shock to nearly the same degree as are the mechanical elements. First of all the motor has the capacity to take considerable overload with no distress other than an increase in operating temperature. Secondly, there is no increase in temperature if the peaks are so spaced as not to raise the integrated power value.



Allmotor type vertical explosion-proof gearmotors drive mixers in an eastern synthetic rubber plant. Units are 15 hp. at 74.8 rpm. output speed.

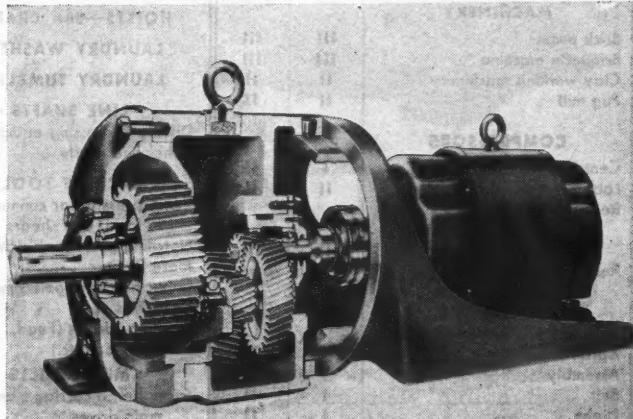


Fig. 3—Triple reduction Allmotor unit showing the simple train helical gearing used for each of the three stages of reduction.

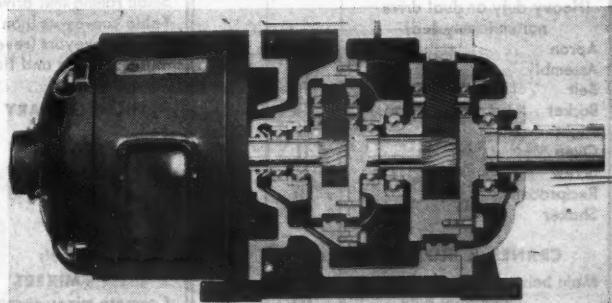


Fig. 4—Planetary gear arrangement employed in a double reduction Integral type of gearmotor. Note compactness of complete unit.

The problem of obtaining proper gear selections for varying degrees of shock loading is best solved by arbitrarily classifying the gearmotor in three separate divisions defined by AGMA as follows:

Class 1. For applications involving steady loads not exceeding normal motor rating and eight hours a day service. Moderate shock loads for intermittent service.

Class 2. For steady loads not exceeding normal motor rating and 24 hours a day service. Moderate shock loads for eight hours a day service.

Class 3. Moderate shock loads for 24 hours a day service. Heavy shock loads for eight hours a day service.

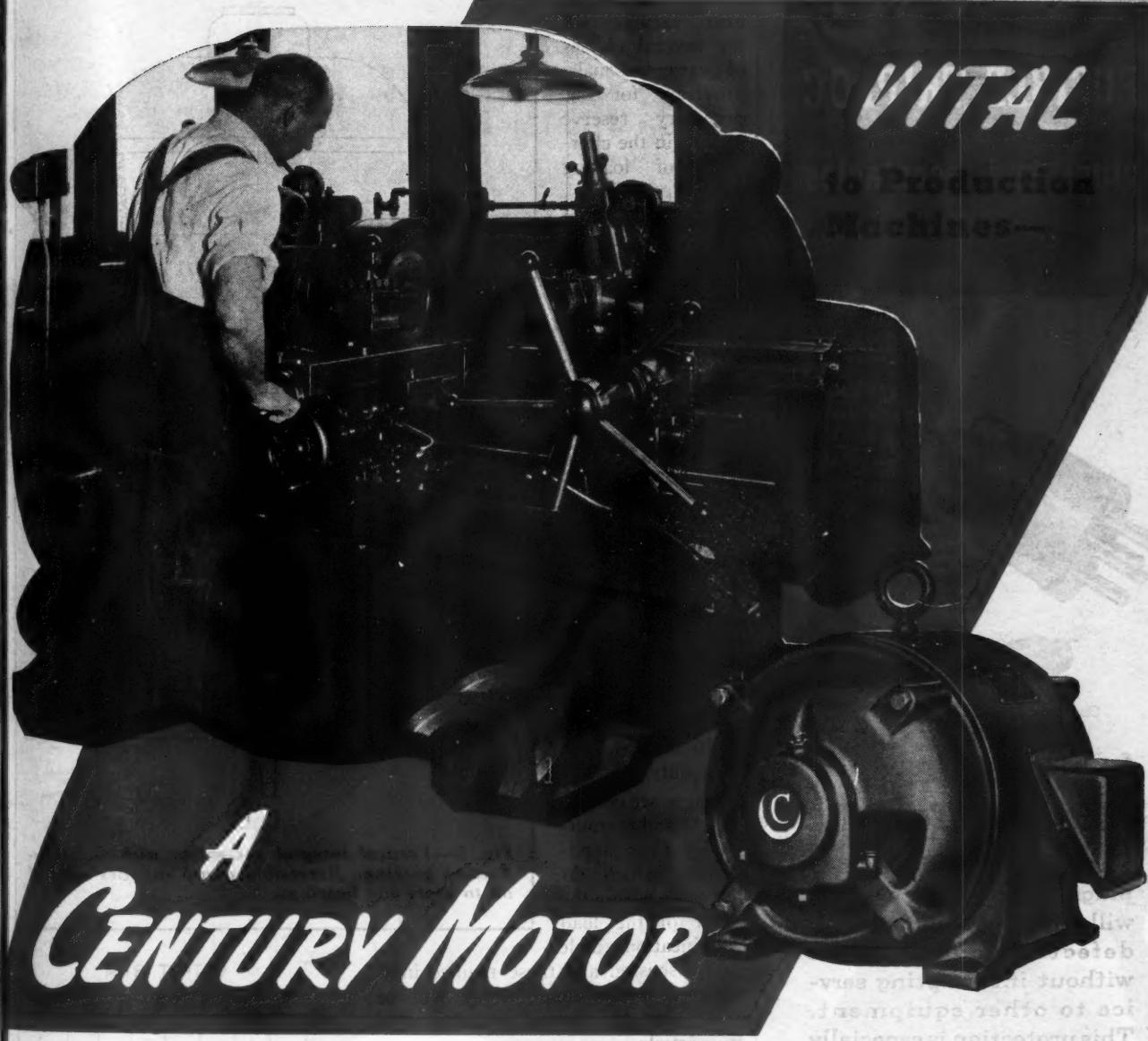
TABLE II
LOAD CLASSIFICATION FOR COMMON GEARMOTOR APPLICATIONS

APPLICATION	CLASS		APPLICATION	CLASS		APPLICATION	CLASS	
	8 to 10 Hour Serv.	24 Hour Serv.		8 to 10 Hour Serv.	24 Hour Serv.		8 to 10 Hour Serv.	24 Hour Serv.
AGITATORS			DREDGES			OIL INDUSTRY		
Pure liquid	I	I	Cable reels	II	II	Oil-well pumping (not over 150% peak torque)	III	III
Variable density	II	II	Conveyors	II	II	Refineries—Chillers	II	II
BLOWERS			Cutter head drives	III	III	Paraffin filter press	II	II
Centrifugal	I	II	Jig drive	III	III	Rotary kiln	II	II
Lobe	II	II	Screen drive	III	III			
BREWING & DISTILLING			Stackers	II	II			
Bottling machinery	I	II	Utility winches	II	II			
Brew kettles, continuous duty	II	II	ELEVATORS					
Cookers, continuous duty	II	II	(Conveyor type—same as Bucket conveyors)					
Mash tubs, continuous duty	II	II	Freight	II	II			
Scale hopper (frequent starting peaks)	II	II	Passenger	III	III			
CAR DUMPERS	II	III	FANS					
CAR PULLERS	II	III	Centrifugal	I	II			
CLARIFIERS	I	II	Cooling towers	II	III			
CLASSIFIERS	II	II	Large (mine, etc.)	I	II			
CLAY WORKING MACHINERY			Light small diameter	II	II			
Brick press	III	III	FOOD INDUSTRY					
Briquette machine	III	III	Beet slicer	II	II			
Clay working machinery	III	II	Cereal cookers	I	II			
Pug mill	II	II	Dough mixer	II	II			
COMPRESSORS			Meat grinder	II	II			
Centrifugal	I	II	HAMMER MILLS					
Lobe	II	II	HOISTS—See CRANES					
Reciprocating, multi-cylinder adequately flywheeled (within 3% cyclic variation)	II	III	LAUNDRY WASHERS	II	II			
Reciprocating, single cylinder	Refer to Factory		LAUNDRY TUMBLERS	II	II			
CONVEYORS (Uniformly loaded or fed)			LINE SHAFTS					
Apron	I	II	Driving processing equipment	II	II			
Assembly	II	II	Other line shafts	I	II			
Belt	II	II	MACHINE TOOLS					
Flight	II	II	Punch press (gear connected to load) and shears	III	III			
Oven	II	II	Notching press (belt driven)	I	II			
Screw	I	II	Plate Planers	III	III			
CONVEYORS (Heavy duty or dual drive—not uniformly fed)			Other machine tools—main drives	II	II			
Apron	II	II	Auxiliary drives (Feed, Traverse, etc.)	I	II			
Assembly	II	II	METAL MILLS					
Belt	II	II	Draw bench carriage and main drives	III	III			
Bucket	II	II	Forming machines	III	III			
Flight	II	II	Pinch, dryer and scrubber roll (reversing)	Refer to Factory				
Oven	II	II	Slitters	III	III			
Screw	II	II	Small rolling mill drives	III	III			
CRANES & HOISTS			Table conveyors (non reverse)	II	II			
Main hoists—medium duty	II	II	Table conveyors (reversing)	Refer to Factory				
—heavy duty	III	III	Wire drawing and flattening machines	III	III			
Skip hoists	II	II	MILLS (ROTARY TYPE)					
Travel motion	II	II	Ball	III	III			
Trolley motion	II	II	Cement Kilns	II			

and 24
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24
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Factory



Can Be Matched to the Exact Requirements of Your Machine

Frequently hidden from view in the base of the machine—usually neglected by the user—that's why there's extra quality, dependability, durability built into Century Motors. They are production tools, too—a component part of the production machines they drive.

Century Motors run quietly and continuously with an unusual freedom from vibration that contributes to precision workmanship, particularly on machine tools.

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Engineers have the knowledge and experience that enables them to accurately match the correct Century Motor to your machine. There is a wide range of AC and DC types and sizes from 1/20 to 600 horsepower from which to choose.

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FUSIBLE TRIPLOC

plugs and receptacles



Connector bodies

Fusible plug

for Portable Electrical Tools

The use of fusible Triploc plugs on extension circuits will automatically isolate a defective tool or device without interrupting service to other equipment. This protection is especially valuable on production lines using numbers of portable tools. Triploc plugs and receptacles are heavy duty types to withstand hard use. The complete range of types includes fusible plugs, cable connectors, and receptacles in many housing types with conduit fitting bodies in standard styles and sizes. Consult your Pyle catalog for complete listings of all types.

THE PYLE-NATIONAL COMPANY

1344 N. Kostner Avenue, Chicago 51, Illinois

The individual gear ratings for the several classes of gearmotors make provision for the necessary reserve to sustain the character of loading broadly described. And the matter of interpretation in terms of selection of a gearmotor for a specific application has been further simplified through the efforts of a committee of representative gear engineers appointed by AGMA to review and classify the entire field of industrial gearmotor applications. Table II shows the class number required for the various kinds of driven equipment normally encountered for 8- to 10-hour and 24-hour duty.

There are certain unique and extraordinary gear applications which do not come within the scope of the load classification table just discussed and these require individual consideration. They will be treated in the second installment of this article.

Overhung Loads

All gearmotors are provided with an output shaft and bearings of sufficient strength and capacity to permit such overhung loads as normally experienced with the use of sprocket, gear or pulley takeoff. The overhung load (a pull on the output shaft applied at right angles to the shaft extension) may be quickly calculated from the formula:

$$L = \frac{63,000 \times H.P. \times M \text{ Factor}}{N \times R}$$

Where: N = r.p.m. of output shaft

R = radius of sprocket, gear or pulley

M Factor = Chain = 1.0

Pinion = 1.25

V-Belt = 1.5

Flat belt = 2.5

The several gearmotor manufacturers show catalogue values of overhung load capacity for the various types and sizes of units and at various output

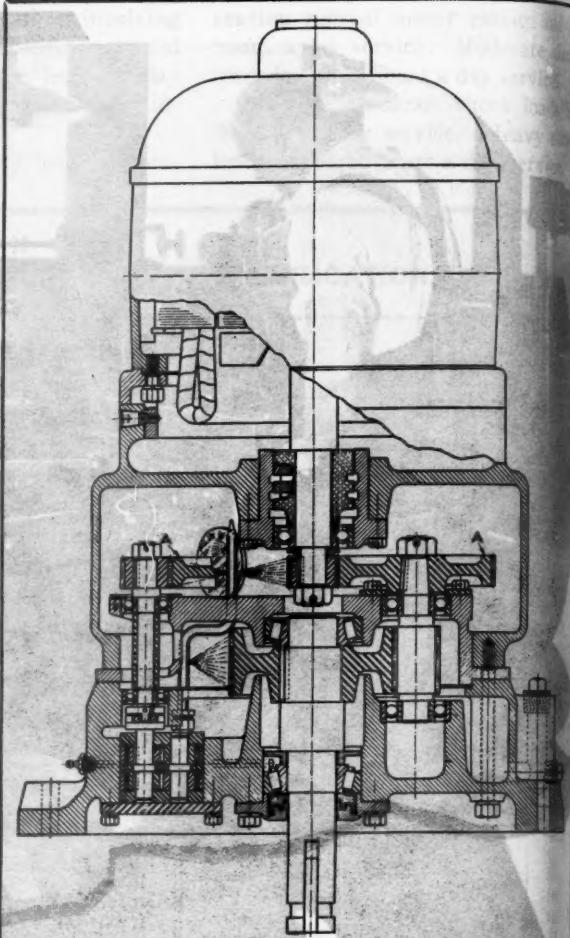


Fig. 5—Vertical integral gearmotor with double reduction gearing. Reversible pump supplies spray of oil to gears and bearings.

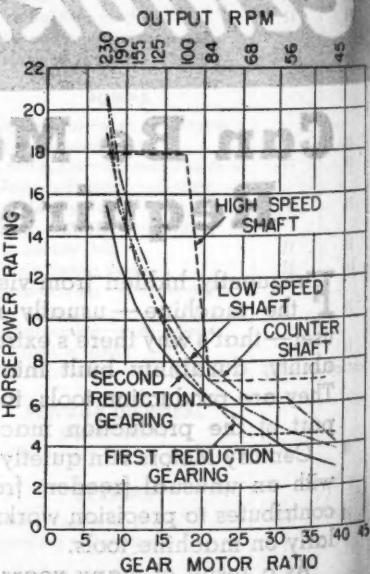
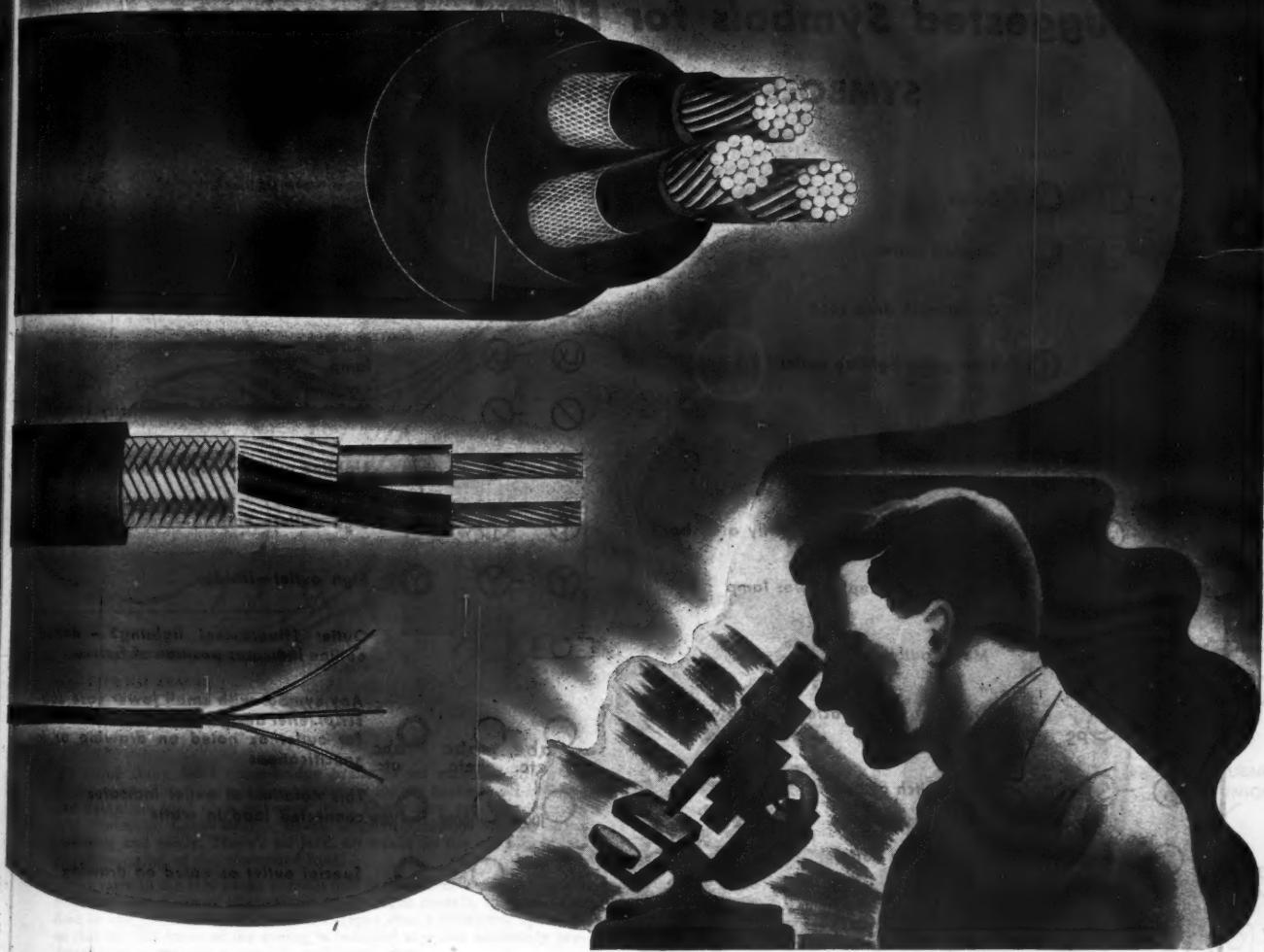


Fig. 6—Horsepower rating curve for a double reduction gearmotor when used with a 1750 rpm. motor. Unit rating is determined by the lowest curve for each ratio.

speeds. It is only necessary to check the calculated overhung load against the tabulated allowable to make sure the permissible values are not exceeded.

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There are few, if any, other fields in which thermoplastics are solving more problems . . . or accomplishing more fundamental changes in industrial design . . . than in the insulation of wire and cable. Demand today the increased resistance which these new compounds and constructions offer to heat, flame, oxidation, chemical action, oil, grease, moisture, cold, abrasion, fungus growth and other severe conditions. Write NOW for complete information and samples engineered to your particular requirements. Remember . . . when you're thinking of PLASTIC you're thinking of US!

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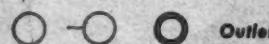
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S-5

Suggested Symbols for Electrical Drawings — II

SYMBOLS FOR OUTLETS — I

CEILING WALL FLOOR



Outlet



Capped outlet



Outlet with drop cord



Emergency lighting outlet



Fan outlet



Flood lighting outlet



Junction box outlet (usually a 4" box)



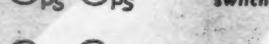
Outlet box receptacle for lamp



Motor outlet



Outlet box receptacle for lamp with pull switch



Pull switch at outlet



Unit heater outlet

CEILING WALL FLOOR



Show case lighting outlet



Outlet for vapor proof fixture



Exit light outlet (sign)



Exit light—outlet box receptacle with red lamp



Lighting outlet—(high intensity lamp)



Lighting outlet—(night light)



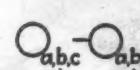
Sign outlet—outside—weatherproof



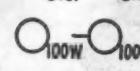
Sign outlet—inside



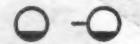
Outlet (fluorescent lighting) — dotted outline indicates position of fixture



Any symbol with small lower case subscript letter designates the type of fixture for outlet as noted on drawing or in specifications



This notation at outlet indicates 100W connected load in watts



Special outlet as noted on drawing

CONVENIENCE OUTLETS

CEILING WALL FLOOR



Duplex convenience receptacle



Single convenience receptacle



Three single convenience receptacles in gang arrangement



Duplex convenience receptacle—weatherproof



Range convenience receptacle—3 wire



Single convenience receptacle—polarized



Duplex convenience receptacle—polarized



Convenience receptacle and single pole toggle switch



Convenience receptacle and radio outlet receptacle

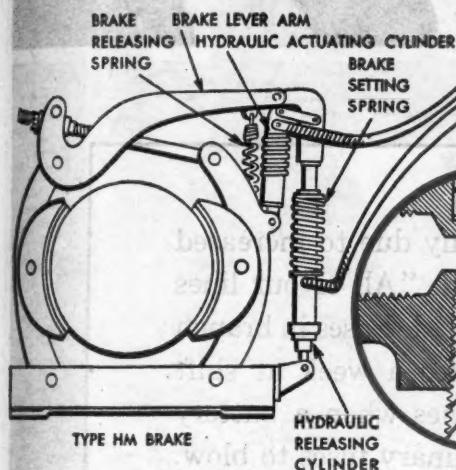
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Information from L. W. Saltz, H. E. Beyster Corp., Detroit.

Only the Wagner type HM HYDRAULIC CRANE-BRIDGE BRAKE

provides ALL THREE requirements of a
PERFECT BRAKING SYSTEM

1. FOOT-CONTROLLED HYDRAULIC BRAKE for service stops
2. AUTOMATIC SPRING-SET BRAKE for parking
3. AUTOMATIC CUSHIONED EMERGENCY STOPS when power fails or crane runs beyond safe limits



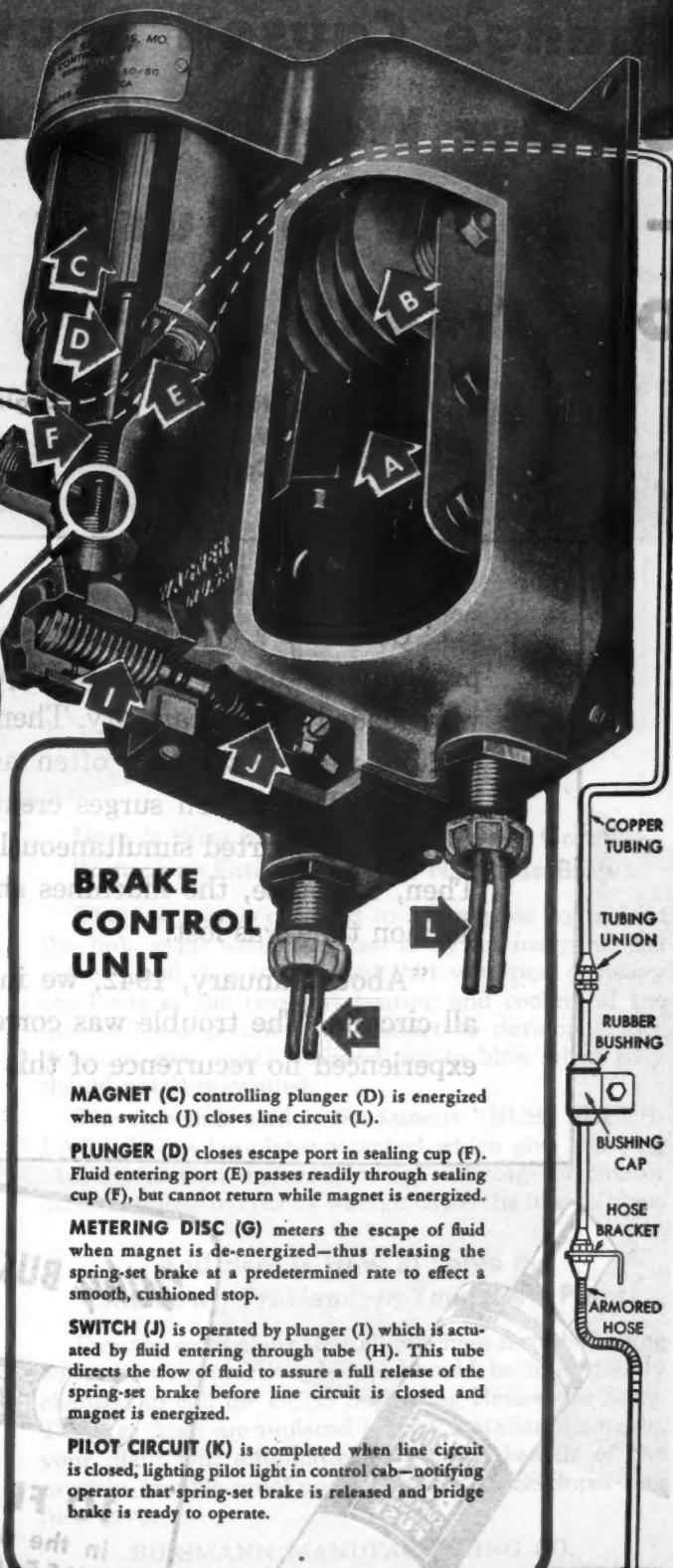
IT'S one thing for a crane-bridge brake to set automatically when the power fails—but it is another matter for the brake to set smoothly and bring the load to a cushioned stop! That's how the Wagner type HM Hydraulic Crane-Bridge Brake stops the bridge and its load: smoothly and safely. There's no jerk, no strain on the machinery, no undue swinging of the suspended load.

A tiny valve in the HM brake control unit is the secret to the cushioned stops. As the cut-away photograph at the right reveals, the hydraulic fluid in the parking-brake cylinder escapes thru a restricted opening, so that the full force of the spring is released at a rate accurately predetermined to provide a smooth, cushioned stop...

The control unit, of which the "Cushion-Stop Valve" is a part, consists of a transformer (A) and a selenium rectifier cell (B) that converts alternating current to 12 volts direct current (the direct-current unit resistors are substituted to reduce the direct-current voltage), a magnetic valve which traps hydraulic fluid in the spring-set brake cylinder, the "cushioned-stop valve", and a pressure switch. The entire unit is simple in design, with very little wear factor and hence very little maintenance involved. The short description at the right will help you to understand how the brake control unit works.

The brake control unit is but one of many features making the Wagner type HM Hydraulic Brake the ideal brake for crane bridges. Among other features are: (1) pushbutton control in crane cab enables operator to set brake as desired, (2) signal light indicates when parking brake is released, (3) brake control can be interlocked with motor pilot-circuit to insure release of brake before starting motor, (4) brake can be set at any time during cycle of crane operation by use of limit switches, (5) can be applied to almost any type of industrial crane equipment.

For a complete discussion of the Wagner type HM Hydraulic Crane-Bridge Brake, read Bulletin IU-186, which we'll gladly send you on request.



Wagner Electric Corporation

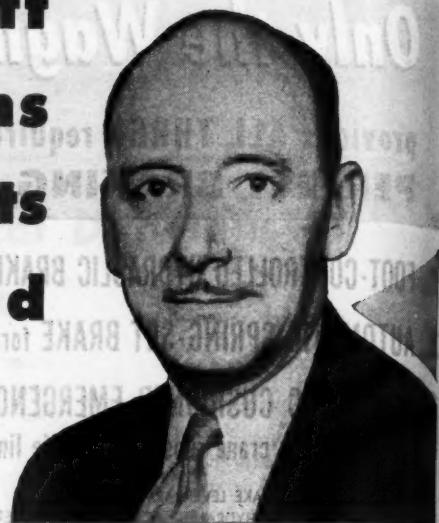
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6413 Plymouth Avenue, St. Louis 14, Mo., U.S.A.
In Canada: Wagner Electric at Leaside, Ontario

ELECTRICAL AND AUTOMOTIVE PRODUCTS

"Electrical Surges at Shift Change Caused Shutdowns On Our War Loaded Circuits — But BUSS Fuses Cured Our Trouble."

Mr. V. R. LUNDQUIST, Plant Engineer
The Benrus Watch Company
Waterbury, Connecticut



"Ours was a typical plant expanding rapidly due to increased production for war," Mr. Lundquist explained. "All of our lines were loaded to near capacity. Then trouble started. Fuses in branch circuits were blowing as often as 5 or 6 times a week at shift changes. The sudden surges created in the lines when a battery of machines started simultaneously caused ordinary fuses to blow. Then, of course, the machines shut down and irreplaceable production time was lost."

"About January, 1942, we installed Buss Super-Lag fuses in all circuits. The trouble was corrected immediately, and we have experienced no recurrence of this costly nuisance."

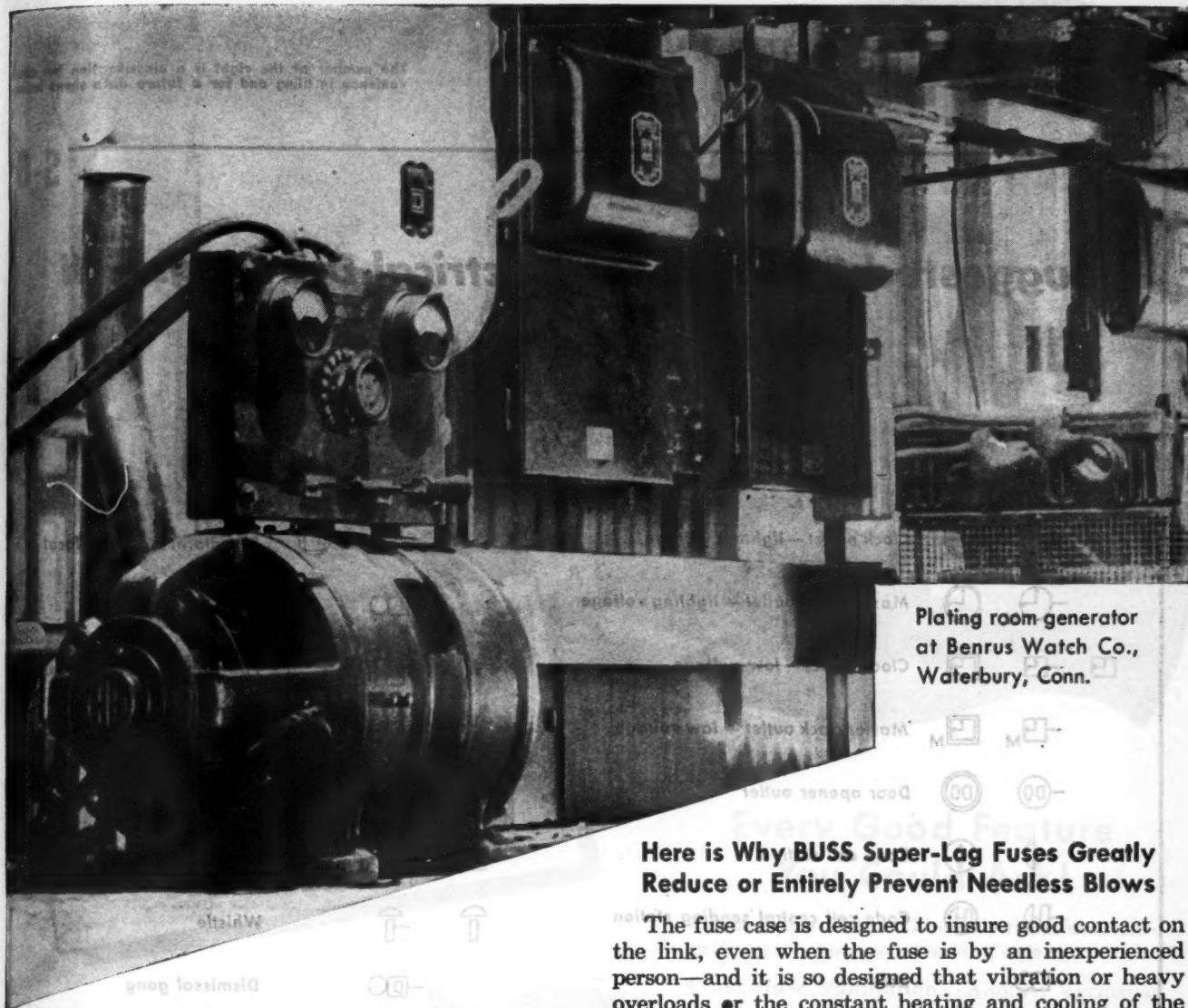


Why BUSS Fuses Don't Blow Needlessly

10 FEATURES
in the design of the
FUSE-CASE help
make it possible

and
The SUPER-LAG
development in the
FUSE-LINK completes
the job.

BUSS



You, too, CAN PROFIT BY STANDARDIZING ON BUSS FUSES

Mr. Lundquist's experience that led him to specify BUSS fuses at Benrus Watch Company is a typical reaction of men who have tried these fuses. It is proof that shutdowns caused by needless blows can be prevented—and adequate protection can be provided in the same protective device.

As for BUSS Super-Lag fuses—the experience of thousands of plants throughout all industry has proven time and again that by using them you can obtain trouble-free protection at a lower overall cost than with any other renewable fuse.

They require no maintenance or periodic inspection. They don't open needlessly. If one opens you know there is some fault that needs correction.

Here is Why BUSS Super-Lag Fuses Greatly Reduce or Entirely Prevent Needless Blows

The fuse case is designed to insure good contact on the link, even when the fuse is by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus, excessive heat which causes fuses to blow when they should not is prevented.

The fuse link used is the famous "BUSS SUPER-LAG." It has lag-plates attached which give it a long time-lag so that unusually heavy starting currents or other harmless overloads will not cause the fuse to blow.

And Here is How to Solve the "Shutdown Problem" in Your Own Plant

Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses give.

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University at Jefferson, St. Louis 7, Missouri
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Super-Lag FUSES

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The number at the right is a classification for convenience in filing and for a future data sheet index.

S-6

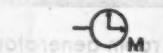
Suggested Symbols for Electrical Drawings — III

SYMBOLS FOR OUTLETS — 2

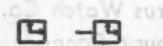
CEILING WALL FLOOR



Clock outlet — lighting voltage



Master clock outlet — lighting voltage



Clock outlet — low voltage



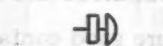
Master clock outlet — low voltage



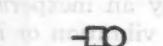
Door opener outlet



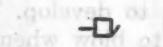
Code call station



Code call central sending station



Bell



Buzzer



Pushbutton station



Announcer outlet



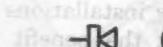
Bell Telephone Co. — telephone location



Bell Telephone Co. — switchboard location



Interphone station



Interphone switchboard location



City fire alarm station



PULL



JUNCTION



BOX



BOX



BOX



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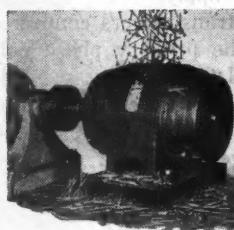


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READER'S QUIZ

TESTING FOR SECONDARY VOLTAGES

QUESTION 182—We have three 2,400, 240 volt, 150 kva. capacity transformers with single phase windings which we wish to connect in a symmetrical bank to a three-phase line of the above indicated voltage. These transformers lack polarity markings. Therefore, will some reader volunteer information on how best to proceed in the manner of testing for the secondary voltages on a step by step basis with only a voltmeter available.—P. C. Z.

A. TO QUESTION 182—The problem of phasing three 2400, 240 volt, 150 kva. single phase transformers for polyphase operation can be solved by the following method. I assume P. C. Z. plans to connect the transformers for delta to delta operation.

This method makes use of the voltage relationship of star and delta connections.

Keep in mind that the voltages of a three phase line are acting 120 electrical degrees apart. When two windings are connected as shown in Fig. 1-a, the voltage across their extremities

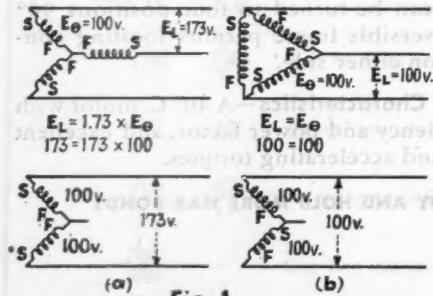


Fig. 1

will be equal to 1.73 times the voltage across one of the windings. When two windings are connected as shown in Fig. 1-b, the voltage across their extremities will be equal to the voltage across one winding.

Connect the high tension side of the transformers in closed delta (See Fig.

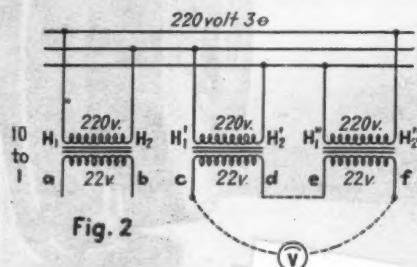


Fig. 2

2.) A knowledge of the correct polarity of the high tension side isn't necessary as the transformers do not have a common magnetic circuit. The polarity of the low tension side will automatically adjust itself in the due process of phasing out. Use is made of a 110, 220, or 440 volt three phase supply which is connected to the delta connected high tension side. In the following example, the high tension side will be connected to a 220 volt three phase supply.

With the transformers connected as in Fig. 2, the primary phase voltage will be equal to the impressed voltage of 220 volts. Since each transformer has a ratio of 10 to 1, the secondary phase voltage will be 22 volts. (See formula below).

The ratio $N_p/N_s = V_p/V_s$
Substituting, $10/1 = 220/V_s$

$$\text{or, } 10V_s = 220$$

$$V_s = 22$$

where N_p = No. primary turns

N_s = No. secondary turns

V_p = primary voltage

V_s = secondary voltage

Temporarily connect a jumper between "d" and "e". Check the voltage across "c" and "f". Should the voltage be found to be 22 volts, the connection is correct thus far for delta operation. However, the voltage might be found to be 38 volts (22×1.73) in which case the connection between "d" and "e" should be disconnected. Connect points "c" and "e" together and check the voltage across "d" and "f". The voltage obtained would be 22 volts which would be correct. Assuming the former connection between "d" and "e" was correct, proceed as follows.

Now, temporarily connect points "b" and "c" together and check the

voltage across "a" and "d" (See Fig. 3). If the voltage should be 22 volts, then permanently connect "b" and "c" together. Assuming that the voltmeter reading was 38 volts, (1.73×22), then disconnect points "b" and "c" and connect points "a" and "c" together. The voltage across points "b" and "d" would be 22 volts. If this be the case, then permanently connect points "a"

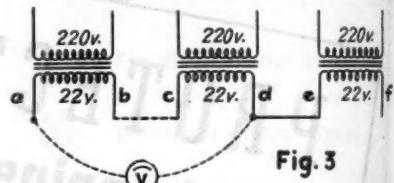


Fig. 3

and "c". Assuming that the former connection between points "b" and "c" was correct, proceed as follows:

Now check the voltage between points "a" and "f" (See Fig. 4) and

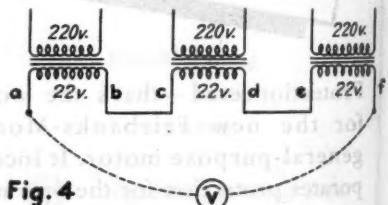


Fig. 4

it will be found to be zero. Since in a delta connection the algebraic sum of the voltages at any instant is equal to zero, the points "a" and "f" may successfully be connected together.

All that remains to be done is to connect three lines to points "a", "c", and "d" respectively. The high tension side of the transformer may now be connected to the 2400 volt three phase supply resulting in 240 volts three phase on the low tension side. Similarly, the low tension winding may be phased for star operation.

The first step would be to connect points "c" and "e" together tempo-

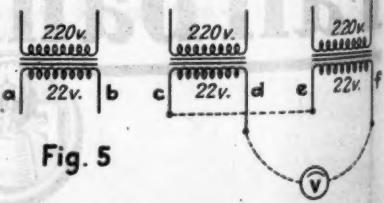


Fig. 5

rarily. (See Fig. 5). Check the voltage across the points "d" and "f". Should the voltage be 38 volts, the connection is thus far correct. However, if the voltage was found to be 22 volts, then disconnect points "c" and "e". Connect points "d" and "e" together and check the voltage across points "c" and "f". The voltage would be found to be 38 volts, the correct voltage for a star connection. Assuming that the former connection was found to be correct, proceed as follows:

Now connect points "a" and "c" together and check the voltage across the points "b" and "d" also "b" and "f" (See fig. 6). Should the voltage readings be found to be 38 volts then permanently connect points "a", "c", and "e" to a common point. However,

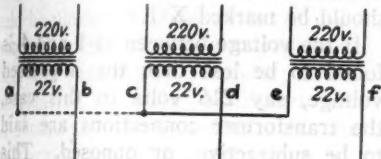


Fig. 6

should the voltage reading be found to be 22 volts, then disconnect "a" and "c" and connect points "b" and "c" together. The voltage reading now obtained would be the correct voltage. If this be the case, then permanently connect points "b", "c", and "d". The secondary winding will be correct for star operation.—L. J. M.

A. TO QUESTION 182—Voltage ratio can be checked by connecting what is believed to be the high tension terminals to a 220 volt line and measuring the voltage across the other terminals. Caution should be exercised until the high tension terminals are positively identified. Then they can be marked H-1 and H-2 as shown in Fig. 1.

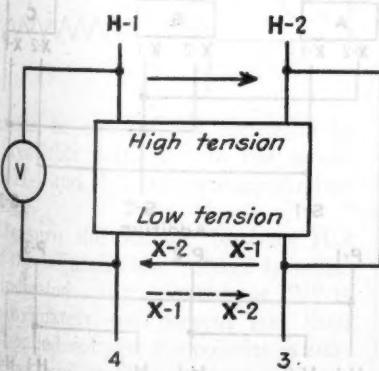


Fig. 1—Test connections

To proceed with polarity testing, H-2 is connected to 3 as shown in Fig. 1. After connecting H-1 and H-2 to a 240 volt line, the voltage between H-1 and 4 is measured. If the reading is found to be 264 in this case, the connections are additive, indicating the

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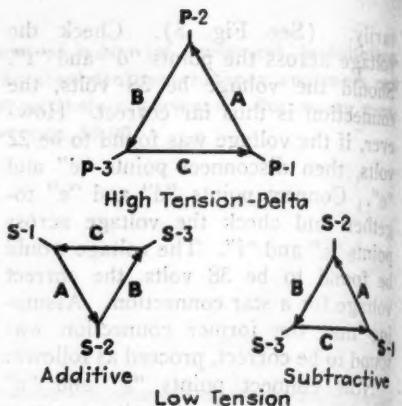


Fig. 2—Voltage diagrams

low tension induced voltage is in the direction shown by the solid arrow on the low tension side. Terminal 4 should be marked X-2 and terminal 3 should be marked X-1.

If the voltage between H-1 and 4 is found to be less than the impressed voltage, say 216 volts in this case, the transformer connections are said to be subtractive, or opposed. This would indicate that the secondary voltage has the direction shown by the dotted arrow. Terminal 4 then should be marked X-1 and terminal 3 marked X-2.

Fig. 2 shows the voltage vectors in a delta-delta connected transformer bank. It will be noted that the phase rotation is the same in each case. But if low tension terminals, the secondary of the additive bank is displaced 180° from the subtractive bank. This is of no consequence unless two banks are to be placed in parallel.

Provided all transformers have equal voltages or ratios of transforma-

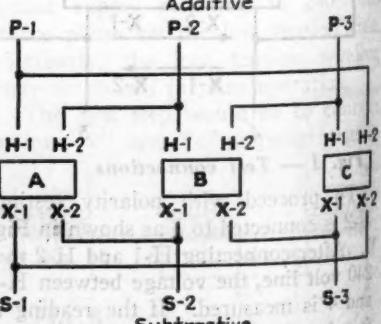
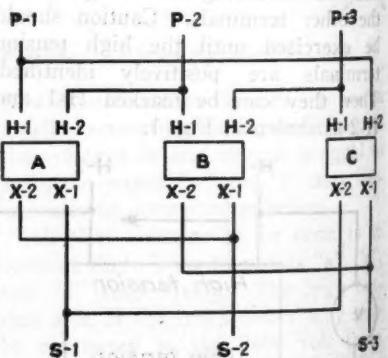


Fig. 3—Connection diagrams

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tion, equal ratios of resistance to reactance, have impedances in inverse ratio to power rating, and there is no phase displacement because of connections, single phase transformer banks can be made to operate in parallel. The whole solution is a process of making the voltage diagrams fit.

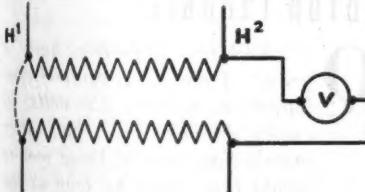
Fig. 3 shows a method of connecting an additive bank to work in parallel with a subtractive bank. It can be checked by drawing voltage diagrams similar to Fig. 2. Before connecting in parallel, the two banks should be "phased out". This is done by cross-connecting, say at S-3, then testing for zero voltage from S-2 to S-2 and from S-1 to S-1.

It must be kept in mind that polarity and voltage diagrams are relative. An additive transformer, for instance, could be placed in a bank with two subtractive transformers by reversing either the primary or secondary leads. The relative directions of the primary and secondary voltages within the one transformer would be unchanged, but the secondary arrow would change in relation to the other two transformers. —L. E. B.

A. TO QUESTION 182—Assuming the transformers have four leads each, the H (primary) leads may be identified by their relatively small size and heavy insulation as compared with the large size and light insulation of the X (secondary) leads.

Represent the four leads in plan as shown in the diagram and mark the two upper leads H-1 and H-2.

Connect H-1 to the adjacent low voltage lead as per dotted line. Then connect an a-c supply of a voltage,



that can be conveniently measured by an available voltmeter, to the terminals H-1 and H-2 and measure the line voltage.

Measure the voltage between H-2 and the adjacent low voltage terminal as indicated. If the voltage at "V" is approximately ten percent less than the applied voltage, the polarity is subtractive and the low voltage lead adjacent to H-1 should be marked X-1. If the voltage at "V" is approximately ten percent greater than the applied voltage, the polarity is additive, and the low voltage lead adjacent to H-1 should be marked X-2.

Make this test on each one of the transformers, taking nothing for



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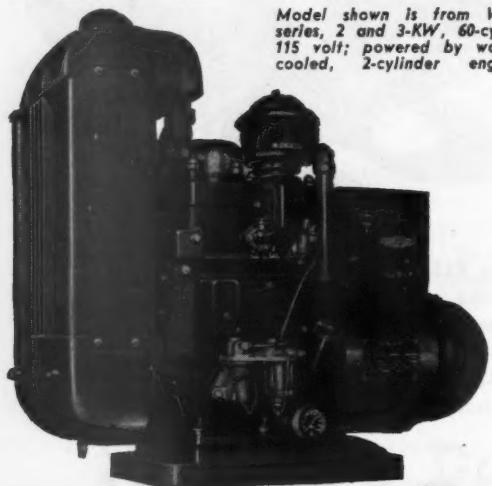
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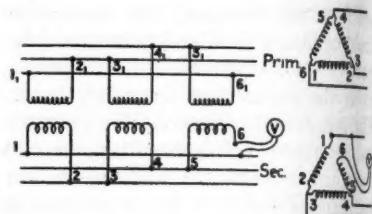
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granted. There are other methods of determining polarity, but none simpler or more reliable.—R. J.

A. TO QUESTION 182—Primary and secondary winding should be delta connected. (1) Connect primary windings symmetrically through fuse cutouts to bus; polarity is of no consequence. (2) Connect secondary windings to secondary bus but leave one lead disconnected; then leave delta connection open. (See diagram.) (3) Connect voltmeter across the open of transformer lead and bus (see diagram). A fuse wire or test lamp will serve as well, in fact, if there is any doubt about the condition of voltmeter a test lamp is pre-



ferred. (4) Energize the transformer by installing light fuses in fuse cutouts and observe voltmeter readings. If polarities are correct the voltage should be zero. If polarity of one transformer is reversed, the voltmeter will indicate a voltage of a magnitude nearly twice that of secondary of one transformer. If the latter condition prevails de-energize transformers, reverse secondary connection of one transformer and repeat the test; if necessary reverse connection on a second transformer.—F. C. L.

ROTOR TROUBLE

Q. QUESTION 183—We have a group of ten 1 hp. squirrel cage induction motors, 220 volts, 60 cycles, 3 phase 3400 rpm. After installation, one of these motors would lose speed as soon as the load was applied. We pulled this motor down and found the rotor had been throwing solder. I sent this rotor out to be tested and was told there was nothing wrong with it. I re-installed the rotor, but it continued to lose speed. I would like to know if anyone has had similar experience and if there is any way I can test this rotor out of the motor. What materials could be used to repair same in case of emergency?—R.E.P.

A. TO QUESTION 183—Your trouble could be in the winding as well as the rotor. Therefore, I would advise you trying the rotor in

one of the other motors. If your results are the same, I would recommend buying a new rotor.

Repairing the old one would require considerable labor and it is very difficult to balance a rotor of 3400 rpm. As to the kind of material, it will depend upon the make of motor and class, which determines whether it is a high or low resistance rotor.

If you found the rotor to be alright in another motor, then your trouble is in the winding, in which case you should first check the connections against one of the others. Should it be found that the coil span is incorrect, the number of turns per coil wrong, or the size of the wire too small or large, it would mean a complete rewinding.—F.F.

A. TO QUESTION 183—Your motor has all the symptoms of poor bar contact. The rotor can be tested by applying a low a-c voltage to one phase of the stator with a suitable ammeter in circuit, then turn the rotor slowly by hand and note the meter deflection. If the current remains steady the rotor is all right, but if the needle fluctuates at different positions then the rotor will have to be resoldered.

If a suitable meter is not at hand a bank of lamps connected in series with the stator can be used and the brilliancy of the lamps noted. For the best results enough lamps should be used to cause the lamps to glow a dull orange with the rotor at a standstill. When a poor contact is passed over a pole, the lamps will dim.

This test can be made with the rotor out of the stator with a growler supplying the magnetic field.

If the rotor checks ok, check the stator for a reverse coil. This can be done by sending a very low d-c voltage through each phase separately and passing a compass around the inner periphery of the stator bore. A magnetized needle suspended on a thread can be used in place of the compass.—T.B.

A. TO QUESTION 183—A similar trouble was encountered in a single phase induction motor. A check of current flow showed that at no load the amperage was about one half the calculated value. A resistance check showed d-c resistance of winding twice that of average windings. The windings were reconnected to have the two poles in parallel instead of series as they were in original connections. The resistance then showed approximately correct.

The motor was put in service after being found o.k. on a test load. This motor has now been in operation every day for the last five months working an average of six hours per day.

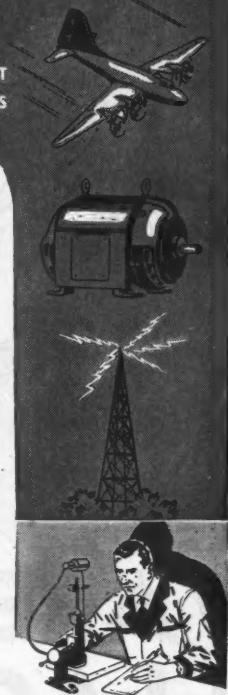
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A. TO QUESTION 183—The modern squirrel cage rotor is so rugged and simply constructed that there is little trouble it could develop aside from loose bars and since you were told the rotor is in good condition, I believe your trouble is in the stator winding. This trouble could also be caused by an overload, but you make no mention of the current drawn or of heating of the winding.

If this group of motors are all the same, try this rotor in one of the other stators and the stator of the defective motor with one of the other rotors. This will locate the trouble, but before you do this, make sure that your trouble isn't caused by an overload.—S.S.P.

Can you ANSWER these QUESTIONS

QUESTION J8 —A suburban residence wired five years ago has developed a ground in kitchen sink when it is full of water (not noticeable at any other time). Wired with Romex, a good job, porcelain boxes in basement, well soldered and taped joints, where checked. Water pump is located in damp room with cement slab roof, attached to, but outside, house. Though trouble might come from there the ground still persisted with that circuit disconnected.

Can anyone suggest a method of locating without disconnecting each circuit and then running it down?—C.N.

QUESTION K8 —Will someone kindly explain a good shop method for making micanite Vee rings for commutators? How can the micanite be cut to the template where a power saw is not available? Must the ends be spliced and, if so, how is it done?—H.A.B.

QUESTION L8 —I have a 110v. single phase motor having 24 slots, which I want to convert into a 3 phase 220v. single "wye" connected motor. Is there a fixed formula to be used in determining the number of turns per coil and size wire to be used?

The original rating of the motor was 2.5 amps.—C.G.S.

QUESTION M8 —How can I adjust a hot water system, so that the hot water will flow through the radiators only when the thermostat starts the circulating pump?—H.S.

PLEASE SEND IN
YOUR ANSWER BY SEPTEMBER 1

FASTEN IT RIGHT THE FIRST TIME

with PAINÉ PRODUCTS



DRILL BITS

"Sudden Depth" Carboyley Tipped Drill Bits cut masonry and concrete 50 to 75% faster, prevent fractured walls, floors and ceilings and assure clean, round, accurately sized anchor, pipe and conduit holes. Can be used in any rotary drill (slow speed). Available in sizes 3/16" through 1 1/4" diams. (graduated in 1/16" sizes).

Star Drill Bits are forged from the finest tool steel to assure long, satisfactory performance. Standard tool for making expansion anchor holes in masonry and concrete, stone, marble, etc. Furnished in 4 point sizes.



WOODSCREW ANCHORS

Lead and Fiber Types
The cheapest and best Anchoring Device available for fastenings in Tile, Marble, Concrete, Slate, Wood and Wood Furring.

Easy to obtain, easy to use. You simply place anchor in hole, insert woodscrew and tighten. No setting tool is needed and hole need not be plumb. Both lead and fiber types expand uniformly as screw is tightened assuring a firm fastening and a workmanlike job. Available on low priority in wide variety of sizes.



TOGGLE BOLTS

Paine Spring Wing Toggle Bolts provide stronger, safer fastenings in hollow material. Easily and quickly installed, they assure permanent support. Available in several head styles in standard bolt diameters from 1/8" to 1/2" in standard lengths.

Special Toggle Bolt Clamp—free with every box of Paine Toggle Bolts—cuts installation time in half and protects the fingers.

Ask your Supplier and Write for Catalog
THE PAINÉ CO., 2961 Carroll Ave.,
Chicago 12, Ill.
Offices in Principal Cities

PAINÉ
FASTENING
and HANGING DEVICES

Electrical Installations

Postwar

[FROM PAGE 79]

fluorescent fixtures, although slightly higher now in initial cost, will greatly reduce these costs. Manufacturers should develop and make available as soon as possible the 100-watt fluorescent instant start tubes and ballasts. The elimination of starters with their resultant troubles will be one answer to the plant engineer's prayers.

Light Colors Increase Efficiency

It is our opinion, also, that light colors tend to improve a person's frame of mind and efficiency. In the effort to maintain workers in clean, congenial surroundings more attention should be directed to painting machinery lighter colors. Many plants clothe their workers in white or light colored uniforms, which are laundered when they get dirty. By the same token the light colored machines should and could be kept clean. Most machines are a grey-black. Can you imagine how cheerful the employees would feel if dressed in the same color? You might question the wisdom of light colored plant equipment from the standpoint of cleaning costs. Yet efforts to keep present grey-black machinery clean is an expense item. Certainly the high cost of keeping windows clean has never deterred an industrialist from putting windows in his plant.

Let's look it from another angle. Refer to a color chart of reflectance values of various colored paints and you will find that grey (lighter in shade than machinery grey) reflects 26 percent of the light striking it whereas any of the buff colors reflects 66 percent to 76 percent. It should be remembered if for economical reasons alone, that the lower the reflection factor the greater the intensity required to perform the particular seeing tasks. This increased wattage is reflected in higher monthly electric service costs. Furthermore, a value cannot be put on the resulting psychological effect.

In postwar commercial and residential lighting design, great effort should be made to get away from "fixtures." The departure will be "built in" units which are a part of the entire scheme or architectural design. The light source is essential, but it does not need to be an eyesore. We are not conscious of daylight or its source and by the same token should not be conscious of artificial light. Proper planning of the lighting system will result in better seeing conditions.

At times like these when plant executives must be ready on a moment's notice to shift plant facilities from one type of production to another, you're lucky if your Motor Control is UNITROL. This newest of all forward steps in Motor Control equipment pioneered by Cutler-Hammer Engineers, gathers up controls scattered throughout a plant, concentrates them into one compact centralized unit that makes room for more control, more machines, more operations. UNITROL houses all the control within the space of a few steps and lightens the labor of servicing and inspection. UNITROL requires no costly building, no costly wall or floor preparation, now or later. And above all, UNITROL makes possible the easiest, speediest and least costly rearrangement and reorganization of production equipment. Only machines, not the control, need be relocated. The individual control units can be changed at will, sections added, taken away or rearranged like the filing cabinet sections in your office.

Take advantage of today's opportunity to modernize your control equipment by replacing it with UNITROL and be ready for the shift, any shift now or in the future. Let a Cutler-Hammer engineer survey your requirements. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wis. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ont.



Engineering excellence finds its greatest reward in the respect and confidence of those it serves

The control is mounted in a UNITROL Door Frame.



The door frame is mounted in a UNITROL Section.



Sections are grouped together and joined.



Present you have a complete, compact plant-serving Motor Control center, ready for any need to come.

Sweated

and wet

and yet perfect performance

DC
DOW CORNING

VARNISHES

TRADE-MARK

high temperature silicone insulation

Humidity, arch foe of conventional insulation, finds its conqueror in Dow Corning 993—the revolutionary new heat stable silicone varnish. Under extreme thermal conditions, **IC 993** definitely excludes water and other conducting materials because it remains flexible and does not crack or carbonize.

Perfect performance of motors and other electrical equipment is assured in normal or overload operation. The combination of heat and moisture resistance in **IC 993** enables greatly extended operation at temperatures of 175° to 200° C., alternating with idle periods and conditions of extreme humidity.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN
ADDRESS ALL INQUIRIES TO BOX 592

FIRST IN SILICONES

Electrical Contracting, August 1945

MOTOR SHOPS

PIERCE
AIR-COOING
DOES DROPS

COIL RACK FOR TEMPORARY STORAGE

The coil winding department in the motor repair shop of the Fred W. Kiemle Co., Toledo, Ohio, is conveniently located in the center of the area occupied by the numerous workbenches devoted to motor rewinding. The square section of floor space allotted to the coil department is surrounded by the winding machines, coil spreaders, taping machines and other equipment.

In the center of the area, directly behind the taping machines stands a metal rack on which completed coils are temporarily stored until dipped and baked or placed in the motor. The rack idea saves valuable floor space that otherwise would be taken up by benches needed for coil storage.

A metal A-frame base, 3 ft. high and 4 ft. long, supports the rack proper. This consists of two 5-ft. lengths of angle iron forming a double tier about 24 inches apart. Welded at right angles to each horizontal member are five bow-shaped arms (see photo) extending 22 inches on each side. Spaced at 14-inch intervals, these arms provide adequate storage facilities for completed coils.



Coil storage rack solves space problem at this Toledo, Ohio motor service shop. Rack is in center of coil department convenient to taping machines. Completed coils remain on rack until winders need them.

Coils are normally made in groups for specific motors. After the taping operation has been finished, the coils are hung on one or more of the rack arms (the number of arms required depending upon the number of coils for that specific job). A job ticket is attached to each group of completed coils for identification when winders pick them up.

Good housekeeping is thus maintained in the winding department with work areas always clean and clear for the job at hand.

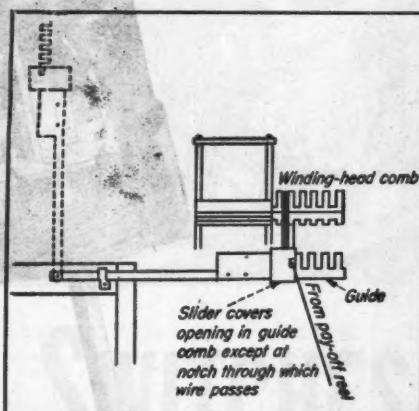
GUIDE FOR WINDING HEAD

To prevent wires from jumping out of the comb slots, even permitting the operator to let go of the wire altogether, except when changing from one slot to another, this winding head guide is employed in The Motor Shop, Los Angeles, Calif. It was designed by Freeman Orne.

The guide is made of heavy fiber board with tooth spacings the same as those on the winding head combs, and set directly opposite but six or



Winding head guide prevents wires from jumping the slots.



Winding-head guide on a swinging arm holds wires in proper position for winding-head comb.

eight inches below the topmost comb. This guide is on a swinging arm, which can be raised to a vertical position as shown by the dotted lines, to get the guide out of the way when taking coils off the combs.

The slider on the guide, also made of fiber, is provided with a notch in the right hand edge. In winding each successive coil, the wire is put in the guide slot opposite the comb slot to be wound and the slider moved over to the right, covering the slot but letting the wire run through the notch.

PIERCE AIR-COOLING DOES DOUBLE DUTY

1

PRODUCTION DUTY

Continuous removal of internal heat keeps link always in condition to absorb successive harmless jolts, preventing needless shutdowns.



COMING

The NEW Pierce
"Balanced - Lag"
Link

SOLD THROUGH LEADING DISTRIBUTORS

PIERCE RENEWABLE FUSES INC.

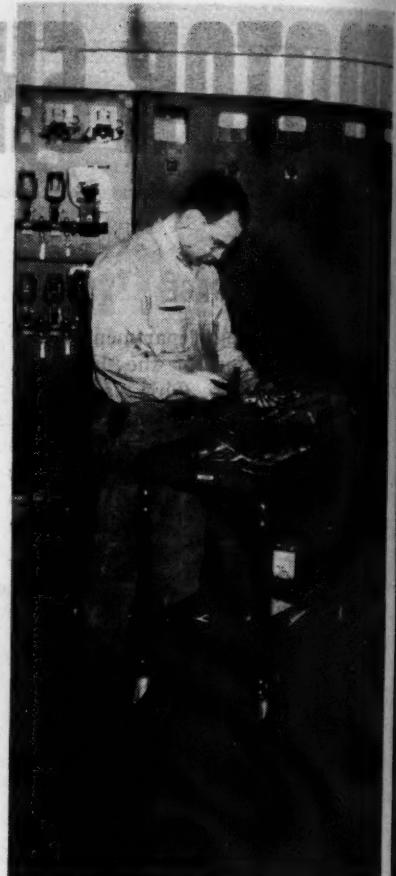
211-219 HERTEL AVENUE

BUFFALO 7, NEW YORK

2

BLOW-TIME DUTY

Extreme pressures due to blow-gases cause pell-mell rush to safety-screened vents. Drafts blow out and prevent arc from forming carbon path which produces case weakness and after-blows.



Handy shop cart—a rolling metal table 30 in. by 15½ in. by 32 in. high—finds many uses in the repair department of Romanoff Electric Motor Service, Inc., new Toledo, Ohio motor service shop. Equipped with small tools, oil cans, small bearing pullers, assortment of bolts, etc., it can be moved wherever needed in the shop.

SKEIN COIL WINDER

One of the tough problems faced by motor repair shops during the war has been that of locating and purchasing urgently needed capital equipment. Faced with rush repair work for key war production plants, and with a lack of the necessary machines, tools and shop equipment to turn out the repair work, they have had to adapt their old equipment to many new uses. Where equipment on hand would not meet all their requirements, tools and equipment have had to be made.

The Evans Motor Repair Shop, Utica, New York, needed a skein coil winder for winding coils of greater length than could be wound on their standard motor-operated coil winder. Being unable to purchase and obtain delivery on a suitable winder, they designed and made one on which skeins up to 88 inches in length can be wound. This winder is shown in Fig. 1.

This new Evans winder was made of lumber, also hard to obtain. It con-



ARROW DEPENDABLE FLUSH SWITCHES

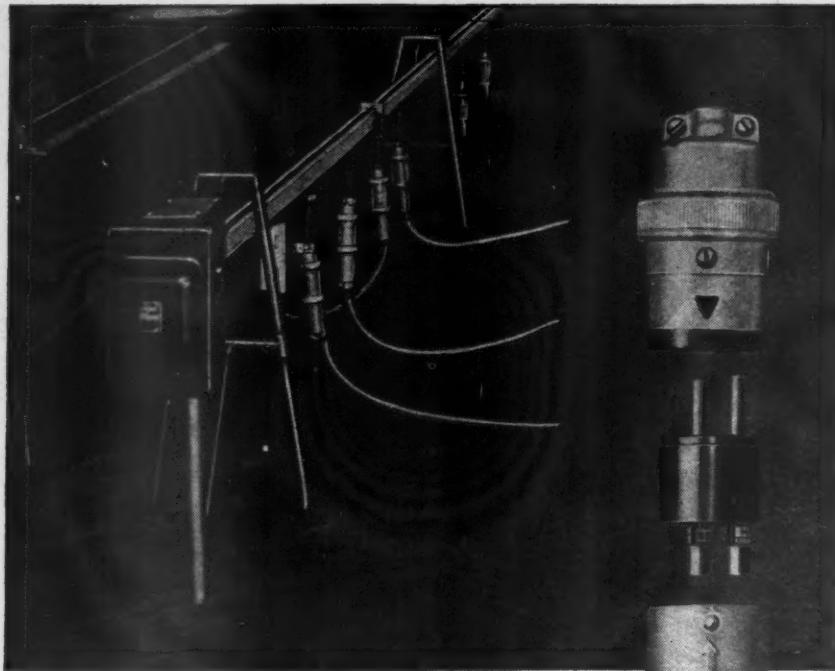
REPRESENTATIVES of leading ARROW Lines for residential lighting control. To ask for these numbers is to specify, in sum, the refinements of 55 years of fine switchmaking. . . . No. TL-1 Lock — and TL-1 — single-pole on Bakelite base only $\frac{7}{8}$ " deep, $\frac{1}{2}$ " wide, $1\frac{1}{2}$ " long; designed for "Type C" lamp loads. No. 1611 — single-pole, composition base, 1" deep.

No. 6445-I — double-pole with "Ivorylite" handle; porcelain base 1" deep. No. 6444 — single-pole, porcelain base 1" deep. No. 1542 — double-pole (20 Ampere), Bakelite base $1\frac{1}{2}$ " deep. Send for Catalog of the complete lines these popular numbers typify.

ARROW ELECTRIC DIVISION

DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U.S.A.



Battery of EVER-LOK connectors on FEEDRAIL in textile plant

EVER-LOK AUTOMATIC LOCKING RECEPTACLES, CONNECTORS & PLUGS

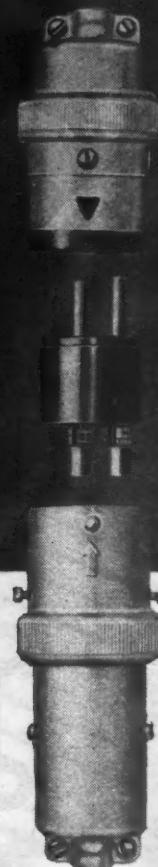
Where uninterrupted service is vital, Ever-Lok connectors insure against faulty contacts, vibration and accidental separation. They are the preferred standard for the connection of high cycle tools and portable equipment.

Locking is automatic and positive. Plugs cannot be inserted the wrong way. Steel clad, dust-proof, self-wiping and self-aligning contacts and positive grounding.

EVER-LOK is made in 2, 3, and 4 pole, 10 to 200 amperes and 2 to 11 pole for signal and control service.

Available in the form of receptacles and plugs for outlet and conduit boxes, surface and gang types, reverse and multiple circuit, weathertight and for cord connectors and also many special modifications not listed in the R. & S. catalog.

Ask for the 300 page R. & S. Catalog.



2-wire 3 pole EVER-LOK with midget or Busman fuses.



EVER-LOK receptacles, also available in gang type.

sists of a one-inch by seven-inch board four feet six inches long, to which is attached a one-inch by four-inch board five feet three inches long, a cross piece made of two pieces of one-inch by two-inch strip, four wood spools, some bolts, screws, and iron pipe spacers. The seven-inch wide board forms the background or base, to which the other pieces are attached. This background board is bolted to the end of a wood work bench in a vertical position.

The five foot three inch long board has a one-fourth inch wide slit cut out of the center nearly the entire length of the board. A scale, calibrated in inches, has been stamped on the face of this board, on one side, which indicates the position for setting the cross piece for various lengths of coils. The scale is calibrated for the coil length, taking into account the length of the cross piece and the diameter of the wood spools. This face board is attached to the base board with two bolts, one at each end, and separated from the base board by means of two three-inch long pipe spacers. This three inch space permits the cross piece to slide up and down the face board freely.

The cross arm consists of one length of one-inch by two-inch strip twelve inches long. Two short pieces of the same strip, each four inches long, are



Fig. 1. Coil winder designed for winding long skein is operated by H. X. Jones in Evans Motor Repair Shop, Utica, New York. Skein coils up to 88 inches in length can be wound on this Evans designed and built winder.

Since 1902

Please address
Dept. No. A

RUSSELL & STOLL COMPANY

EXPLOSION-PROOF, WATER-TIGHT, INDUSTRIAL LIGHTING FIXTURES
AND EQUIPMENT. AUTOMATIC LOCKING "EVER-LOK" CONNECTORS.

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FOR GREATER CARRYING CAPACITY
ECONOMY AND SAFETY . . .

USE MODERN PORCELAIN PROTECTED WIRING SYSTEMS

for



RESIDENTIAL - COMMERCIAL - INSTITUTIONAL
INDUSTRIAL AND RURAL INSTALLATION

MODERN PORCELAIN Protected Wiring Systems are providing real sales opportunities for electrical contractors throughout the country in residential, industrial, commercial, and institutional wiring installations.

features which make this system so popular are its economy, which has been developed to the highest degree, elimination of extraneous and unessential conductors and materials necessary in some locations for mechanical protection only, and an Economical Adequacy that can be compared by no other wiring method. These features have been achieved through the use of all porcelain outlets, conductor supports, and the use of air as an insulating medium and heat dissipator.

For instance, the hazards that are present in most residential occupancies and which, until the development of the Porcelain Protected System, presented electrical contractors and inspectors with a serious problem.

Fixtures in kitchens, bathrooms, and basements are representative of particular hazards, and the Porcelain Protected System has overcome this problem most successfully.

When carrying capacity is considered, the electrical contractor is presented with a distinct advantage, either from the point of economy or greater capacity. The 1940 National Electrical Code recognizes the superior carrying capacity and safety of conductors used in this system, so if the contractor's problem is one of economy, he may use a smaller size conductor than permitted in other wiring methods; or, if his problem is that of adequate carrying capacity, he can achieve a larger capacity at lower cost with this system than with any other when like wire sizes are considered. The electrical contractor can apply these features to his best interests, in commercial, institutional, industrial, and rural installations as well as residential.

* ILLINOIS ELECTRIC PORCELAIN CO.
Macomb, Ill.

* PORCELAIN PRODUCTS, INCORPORATED
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* SPECIALTY PORCELAIN WORKS
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MODERN PORCELAIN PROTECTED WIRING SYSTEMS

27 BULLETINS on
Ball Bearings—their installation, use
and maintenance. Available to shop men,
maintenance men, engineers, designers
and draftsmen.



SENT ON YOUR REQUEST; write, giving your title
or position and name of company.

M-R-C BALL BEARINGS

MARLIN-ROCKWELL CORPORATION

Executive Offices: JAMESTOWN, N.Y.

attached to the twelve inch long strip. On each end of the cross piece is attached a one-inch diameter by two-inch long wood spool.

At the top of the face board, two similar spools are attached, end to end by means of a bolt through both spools and the face board. This completes the assembly of the skein coil winder, except for a nail located in the side of the baseboard near the top.

The coil is wound by tying one end of a wire to the nail, and winding the necessary number of turns over the spools. The cross piece is then loosened and the wire coil removed from the winder.

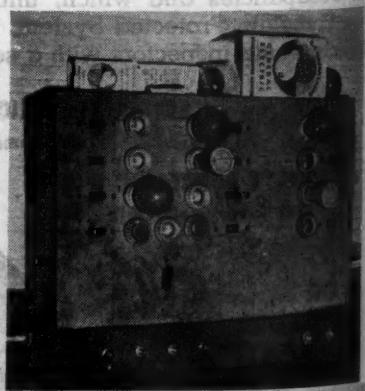
PULL BOX MAKES TEST PANEL

Over the small motor repair bench at the Romonoff Electric Motor Service, Inc., shop in Toledo, Ohio, are two dead-front test panels fashioned from ordinary pull boxes. Each sheet steel box is 24 inches long, 18 inches high and 6 inches deep with an interior barrier separating the a-c and d-c test sections.

A 3-phase, 4-wire, 120/208-volt line feeds the left side of the cabinet to provide the 110 and 220-volt test facilities. The right half is fed by a 120-volt d-c line.

On the standard screw cover of the box are mounted the necessary sockets for the lamp and resistor banks, each individually controlled by a flush toggle switch. One socket of each bank is used for fuse protection. The same applies to the d-c side of the test panel.

Test terminals are mounted to a strip of fibre at the lower edge of the panel face; four on the a-c side to secure the 110 and 220 volts; two on the opposite side to secure the d-c. A number of lamps and resistors are always kept on hand at each test panel.



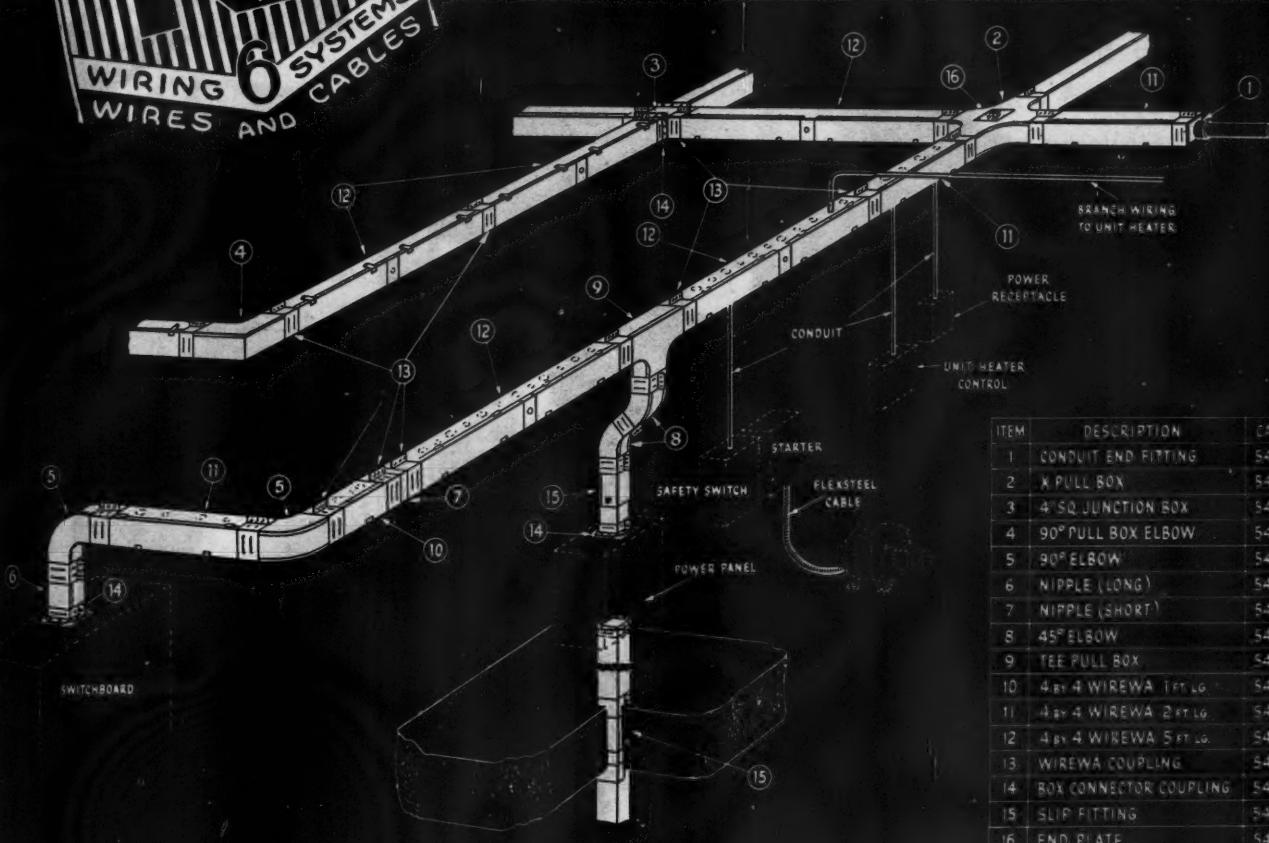
Dead front test panel fashioned from ordinary pull box. Each socket is controlled by a flush toggle switch. Panel provides test facilities for 110-v., single phase; 220-v., single and 3-phase; and 110-v., d-c.

Specify National Electric



"4 x 4 WIREWA"

for industrial extensions
and rewiring jobs



ITEM	DESCRIPTION	CAT. NO.
1	CONDUIT END FITTING	544C30
2	X PULL BOX	544XB
3	4" SQ JUNCTION BOX	54484
4	90° PULL BOX ELBOW	544PL9
5	90° ELBOW	544L90
6	NIPPLE (LONG)	544N6
7	NIPPLE (SHORT)	544N3
8	45° ELBOW	544L45
9	TEE PULL BOX	544TB
10	4x4 WIREWA 1 FT. LG	544W1
11	4x4 WIREWA 2 FT. LG	544W2
12	4x4 WIREWA 5 FT. LG	544W5
13	WIREWA COUPLING	544C
14	BOX CONNECTOR COUPLING	544A
15	SLIP FITTING	544SF
16	END PLATE	544EP

(Sketch of a 4 x 4 WIREWA installation showing complete flexibility, simplicity and use of fittings.)

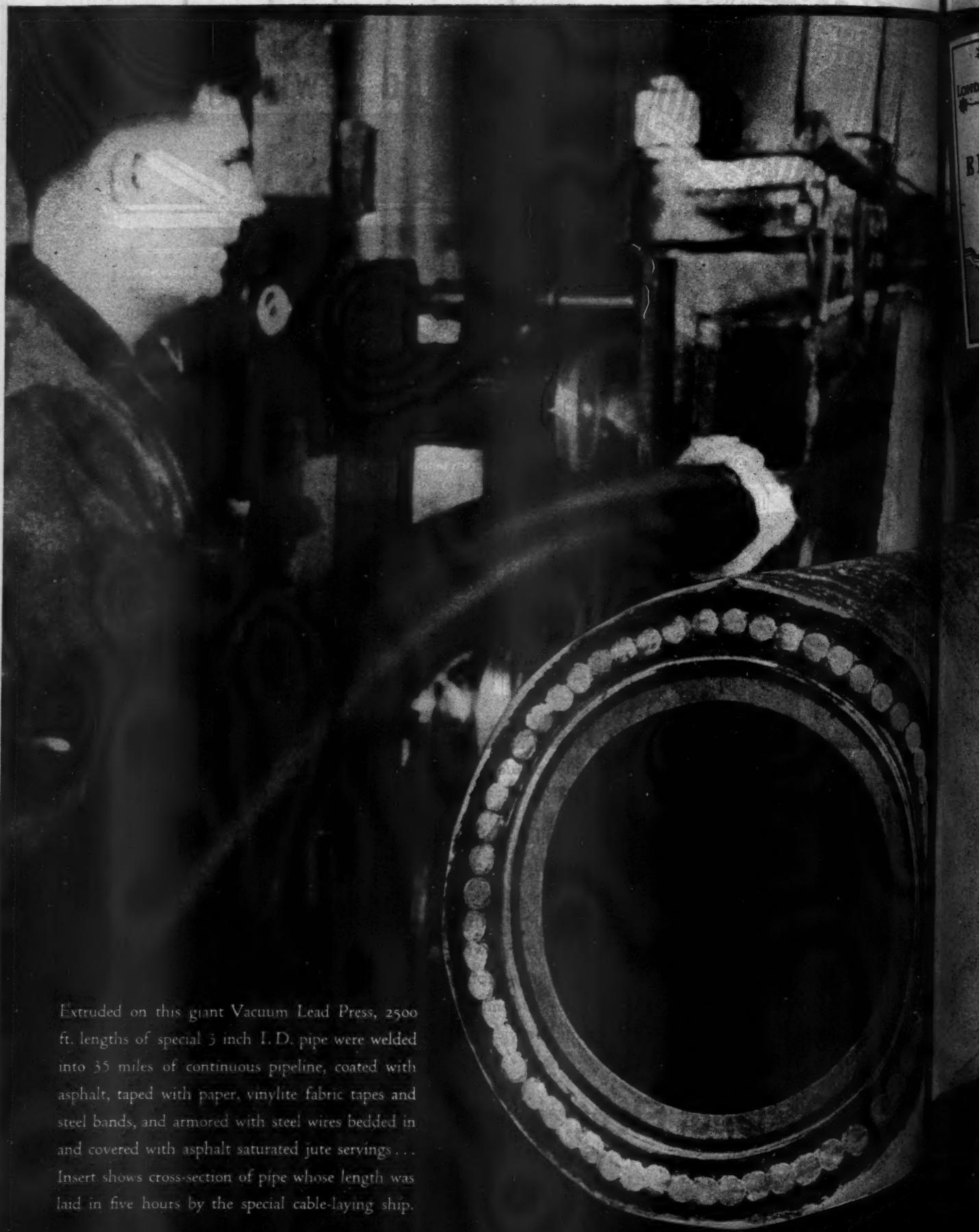
For housing of plant power systems and extension and rewiring of lines up to 600 volts, specify National Electric 4x4 WIREWA. Complete, easy to install, providing an area of 16 square inches and permitting an unusually high degree of flexibility and accessibility, this system has found wide acceptance in a variety of plants. Write for descriptive literature. National Electric also manufactures a complete line of wires and cables—famous for their long service and saving of space.

A FEW MAJOR REASONS WHY THE NATIONAL ELECTRIC 4 x 4 SYSTEM IS SO POPULAR

- Maximum usable space permitting greatest number of wires.
- Ease of installation and accessibility for tapping, rerouting, etc., without disturbing existing installation.
- Greater flexibility to meet specific local conditions.
- May be mounted direct to wall or by means of standard hangers suspended from the ceiling.

National Electric Products Corporation
Pittsburgh, Pa.

A PIPE DREAM



Extruded on this giant Vacuum Lead Press, 2500 ft. lengths of special 3 inch I.D. pipe were welded into 35 miles of continuous pipeline, coated with asphalt, taped with paper, vinylite fabric tapes and steel bands, and armored with steel wires bedded in and covered with asphalt saturated jute servings. . . . Insert shows cross-section of pipe whose length was laid in five hours by the special cable-laying ship.

COME TRUE . . .



With the active interest of General Eisenhower, and Allied officers, Admiral Lord Louis Mountbatten conceived a series of pipelines under the English Channel to feed precious oil and gasoline to Allied fighting forces speeding across France, Belgium, Luxembourg and Germany.

Experience in making the largest submarine electric-power cables enabled General Cable to volunteer undertaking its part of this important contract with its own existing facilities. General Cable quickly started making this continuous 35-mile pipe, thanks to available equipment commandeered from its coast-to-coast plants, its wealth of research and engineering talent, plus dogged determination to speed Victory. In about nine months from installation, the under sea traffic fuel from England to the continent via channel pipelines had totalled 120,000,000 gallons, freeing oil tankers, cars and other transport for more vital duties. With public recording of this secret comes the buoyant feeling that dreams do come true and many more, as yet unrevealed, will foster progress in a peace we all can share.

GENERAL CABLE CORPORATION



General Cable Corporation Sales Offices are located at Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Kansas City (Mo.), Los Angeles, New York, Philadelphia, Pittsburgh, Rome (N.Y.), St. Louis, San Francisco, Seattle, Washington (D. C.)

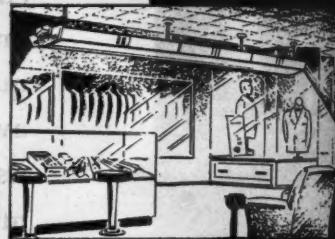
it's easy to see when it's "Day-Brite"



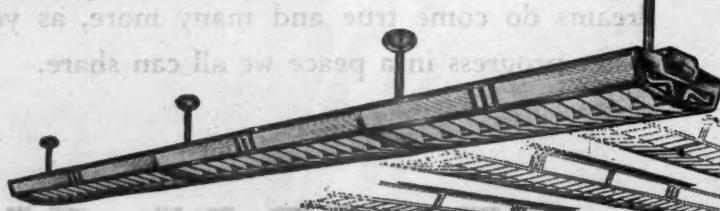
CONTINUOUS Quality

For continuous installations, either surface or suspension mounting (both illustrated on this page) the VIZ-AID supplies added evidence of the quality that's easy to see when it's Day-Brite....

Styled for beauty, engineered for utility—these fixtures are particularly suitable for commercial use.... Consult your nearest Day-Brite Engineering Representative.



VIZ-AID
Suspension
Mounting



VIZ-AID fixtures are also furnished for unit mounting. Each section accommodates two 40-watt lamps... Write for Bulletin 10-B.

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Day-Brite
LIGHTING FIXTURES

Nationally distributed through leading electrical supply houses

MODERN LIGHTING

100 FOOTCANDLE OFFICE LIGHTING

The importance of good lighting from the standpoint of production, better quality of work and improved employee morale is a recognized fact at the Nordberg Manufacturing Co. of Milwaukee, one of the country's leading builders of Diesel engines and other types of heavy machinery. This is shown by the extensive relighting program started in 1940. Nordberg doesn't subscribe to the half-way "that'll get by" attitude. It seeks and secures the best available.

Evidence of the modern trend toward improved lighting can be found in the various offices and in the Engineering Department at Nordberg. Because of the exacting nature of the work performed, especially in the Engineering Department, it is essential that eye fatigue due to improper lighting be eliminated. Hence a fluorescent lighting system that provides a maintained intensity of 100 footcandles was designed and installed.

Considerable research went into the choice of fixtures. Conventional models then on the market were carefully studied; consultations were held with lighting engineers and the local utility company. The outcome of it all was a special fixture designed and patented by the company, which met the desired requirements—a three-lamp, 40 watt,

enclosed unit with a cut-off so designed that it would permit removal of the center lamp without leaving a dark area in the light pattern. The installed fixtures consist of a four-foot, three-lamp (3500 degree white) fluorescent unit enclosed on the sides and bottom with frosted Flutex glass and clear glass top panel to keep out dirt and dust.

The units were installed in continuous rows, on 5-ft. centers, parallel to the width of the 60-ft. by 120-ft. area. Mounting to the 10-ft., ivory colored acoustic ceiling was accomplished with L-shaped brackets which kept the units a few inches from the ceiling level. The design of bracket was such to facilitate installation work. Ivory colored, glazed tile walls and columns add to the efficiency of the lighting installation.

Alternate units are balanced on the 3-phase, 4-wire circuits, to balance the load on the system and minimize stroboscopic effect. Flexible control of the units from circuit breaker panels permits the use of as many units as are necessary—depending on the type of work being done at the time and the intensity and quality of outdoor natural light.

Readings taken after 600 hours of operation indicated an intensity of 100 footcandles on the working plane. This is to be regarded as the maintained intensity with the units getting a thor-



Close-up of typical unit shows the three-lamp construction with frosted Flutex glass side and bottom panels and clear glass cover on top. Where columns interfere with continuous rows, dummy sections are installed to column line.

ough cleaning every three months.

As will be noted in the accompanying photograph, the ceiling is concealed from view in the normal line of vision, so that only the luminous side and bottom panels of the continuous rows of equipment are visible. This creates an illusion of a "sheet" of light covering the entire ceiling, especially noticeable in a long room. This condition is not objectionable in this installation, however, for two reasons. First, the brightness of the fluorescent lamp tubes is considerably reduced by the Flutex glass side and bottom panels. Second, the resultant illumination intensity, being over 100 footcandles, is sufficiently high to prevent an objectionable contrast in brightness between the lighted glass panels and lighted objects in the room. Consideration of this and other similar factors were responsible for the design used to produce the desired lighting result.

The relighting program was under the supervision of Carl Lau, chief electrician of Nordberg. The wiring of the fixtures and the installation of the system was participated in by three Milwaukee contractors: Staff Electric Company, Uihlein Electric Company and Knoerr & Fisher, Inc.



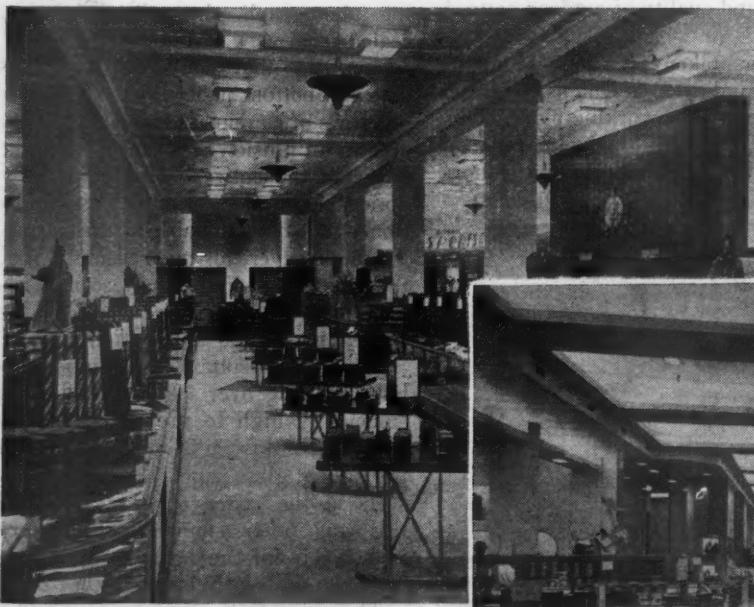
Three lamp units maintain 100 footcandles of cool, evenly distributed, fluorescent illumination on the working plane in this Nordberg Manufacturing Company office area. Critical seeing tasks involve the study and checking of plans and specifications.

PLANNED LIGHTING



The sign over the show windows of Schmanke's Boot Shop is illuminated with 100 watt bowl silvered lamps on 30-inch centers. These are installed approximately 30 inches behind the diffusing glass panels and the entire interior box painted white. Metal letters are thus silhouetted against evenly lighted diffusing glass background.

The Star Market planned its lighting around recessed mat porcelain enamelled reflectors and 300 watt bowl silvered lamps. Located on 10-foot by 11-foot spacings, and centered over aisles, these widespread light distribution units provide approximately 25 foot candles average on displays. (Right)



Main floor of National Clothing Company's store combines indirect lighting for general illumination with direct lighting for highlighting merchandise and displays. Indirect fixtures are 1000 watt units, and direct lighting lens units each contain four 300 watt lamps. This planned lighting averages 30 footcandles on the merchandise.



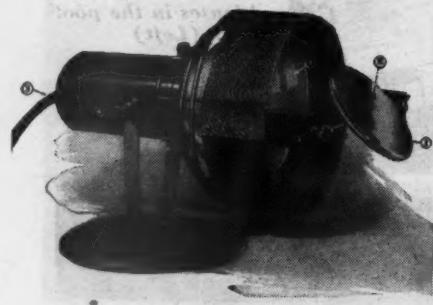
Eight examples of planned lighting in Rochester, N. Y., showing typical Lighting Techniques used in this community to light its commercial and recreational facilities.

B. Forman Company achieves unusual decorative effect plus light for selling on main sales floor by combination of fluorescent cove lighting and recessed lens incandescent lighting. Floor and wall display cases are also lighted with fluorescent lamps. Entire ceiling is planned for cove lighting, creating the effect of large surface low brightness ceiling coffers. (Below)

McGILL

INSIDE INSPECTOR

LAMP NO. 7500



Brings the Inside OUTSIDE

The new **McGILL INSPECTOR LAMP**, No. 7500, makes the inspection of shells, cavities, castings, tubes and other objects with a deep opening easy. Burrs, grease and defects cannot escape detection. The inspector doesn't squint and strain. A strong light is thrown inside where the light is needed . . . NOT in the eyes. The operator simply looks into the adjustable mirror. Write for data.

FEATURES OF THE No. 7500

1. 100 Watt—120 Volt—No. R-40-Spotlight
2. Adjustable Mirror
3. 12 ft. Insulated Cord and Plug
4. Adjusting Wing Nuts to Allow for Tilting
5. Wing Nuts for Mirror Adjustment
6. Inspector's Vision at this Point

ELECTRICAL DIVISION

McGILL
MANUFACTURING CO., INC.
VALPARAISO, INDIANA

SYLVANIA LIGHTING CENTER FEATURES RESIDENTIAL LIGHTING

Modern styling can be applied to fluorescent lighting fixtures for the home. Fluorescent lighting can be combined successfully with incandescent in the same room. Fluorescent lamp sources are adaptable to unusual applications in utilitarian and decorative lighting, and in "painting" with light.

These facts are borne out by demonstration in the new Lighting Center, recently opened in New York by Sylvania Electric Products, Inc. This new Sylvania Lighting Center comprises a group of rooms, including living room, bedroom, study, kitchen and bathroom, to serve as a company laboratory for experimenting with new residential lighting ideas and evaluating them over a period of time in their normal surroundings, according to William F. Rooney, head of The Product Styling Group. It is the result of months of research by company engineers, stylists and architects, working with Lurelle Guild, the noted design consultant.

Throughout the Center will be found modern and attractive fluorescent lighting, designed especially for the home. All of these are new designs, and applications are attractively displayed in a typical home setting. They have all been selected carefully to harmonize, either lighted or unlighted, with the color of walls and decorations. The color quality



This corner of living room shows new "panel of light" ceiling fixture and simple decorative corner fixture, both designed for fluorescent lamp sources. Portable incandescent floor lamp may be used for high level lighting, and combines well with fluorescent units.

of light sources used has also been taken into consideration to assure proper color harmony between the lighting and the decorations.

Both incandescent and fluorescent light sources have been used successfully in the living room and bedroom, thereby refuting the bugaboo idea that this combination clashes. The combination presents a soft, pleasing effect as well as providing ample and comfortable light for all seeing tasks.

In the living room, fluorescent



Living room in the new Sylvania Lighting Center, New York combines fluorescent and incandescent light sources for pleasing atmosphere and flexible lighting result. Incandescent floor and table lamps furnish high level lighting for each seating unit. Fluorescent ceiling fixture (not shown in picture) and fluorescent lamps concealed behind window valance provide soft general lighting and decorative treatment.

Fluorescent Light Rays ARE Diffusing BUT... THEY CAN BE CONTROLLED with **Guth ALZAK* FLU-O-FLECTORS[†]**

The even distribution and high intensity of light in this warehouse installation for a large Eastern manufacturer is a result of "punch-design" ALZAK Aluminum Reflectors in GUTH FLU-O-FLECTORS. The scientific engineering in this amazing fixture controls and directs light-rays to the useful working plane, notwithstanding the diffusing characteristics of the fluorescent light-source. FLU-O-FLECTORS control the light, and direct it where it will do the greatest good. Like a series of bouncing balls, the light-rays bounce off FLU-O-FLECTOR's engineered contour in a pre-determined direction.



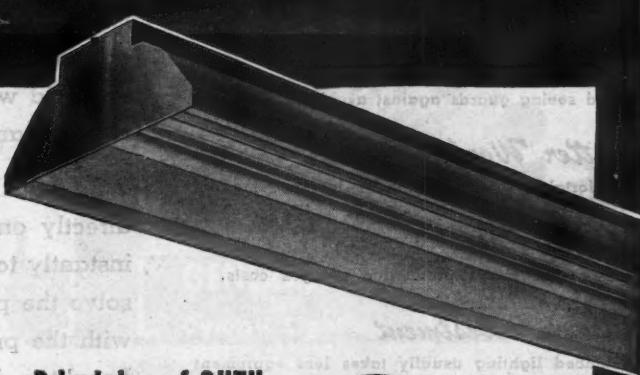
INSTALLATION DATA

One hundred and sixty GUTH FLU-O-FLECTORS, each with four 40-watt white fluorescent lamps, are installed to illuminate this area—120' wide by 200' long (10 bays at 20'). FLU-O-FLECTORS are mounted along the roof trusses on 6' centers—therefore spacing is 6' x 20'. The mounting height is 22' 3" above the floor. 20 to 25 Foot-Candles of light is delivered at the working plane. This means only 0.75 watts-per-square-foot for 20-25 Foot-Candles (in service) on 22' mounting!

FLU-O-FLECTORS DATA

Outer housing of heavy-gauge steel with welded-on closed End-Plates, is finished "300° Gray." Inner reflector is of #1 Reflector-Sheet Aluminum, processed ALZAK* for guaranteed efficiency and permanency. Reflectors are removable for easy cleaning. FLU-O-FLECTORS are available with Conventional or QUICK-LITER accessories. FLU-O-FLECTORS can be mounted as individual units, or butted end-to-end; can be installed on conduit, or with chain hangers.

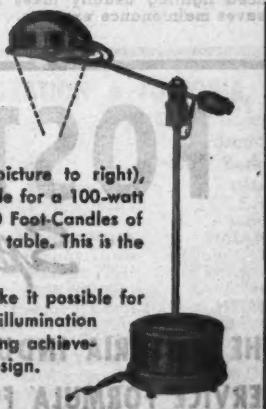
*T.M. Reg. Alum. Co. of America, Pittsburgh, Pa.
†T.M. Reg. E. F. Guth Co., St. Louis 3, Mo.



Principles of GUTH Surgical Fixture Applied to Fluorescent

In the GUTH Surgical Fixture (picture to right), engineered design makes it possible for a 100-watt Incandescent lamp to deliver 1000 Foot-Candles of illumination on the operating-room table. This is the result of scientific light-control.

The same principles of control make it possible for the FLU-O-FLECTOR to direct illumination where wanted—an outstanding achievement in fluorescent fixture design.



THE EDWIN F. GUTH CO.

Guth

2615 Washington Ave., St. Louis 3, Mo.

Electrical Contracting, August 1945

TO SPEED AND
INCREASE PRECISION
PRODUCTION—

HELP YOUR
MANUFACTURING
THE VITAL



LOCALITE Model 3267-H-102-SV

Directs up to 200 footcandles intense illumination on critical work. Used for small machines, lathes, grinders, drill presses, etc.

Increased Production

Enables workers to see faster and comfortably which speeds their task.

Fewer Errors

Quick, accurate seeing avoids costly mistakes.

Reduced Accidents

Good seeing guards against accidents.

Better Work Morale

Comfortable seeing conditions increase morale.

Lower Costs

Faster and better production reduces costs.

Lower Investment

Balanced lighting usually takes less equipment and saves maintenance expense.

LOCALITE Model 3470-P-172-SV

Directs up to 300 footcandles intense illumination on critical work. Used for bench and table operations, assembly, sorting, inspection.

ILLUMINATION OF THE RIGHT QUALITY AND RIGHT FOCUS FOR SPECIFIC SEEING TASK

The first requirement for speed and accuracy on any precision task is easy, comfortable seeing. For machining, assembly and inspection operations, the seeing tools must provide 100 footcandles and more to avoid worker handicap — must be flexible in positioning so the worker can direct illumination exactly where he needs it.

With Localites, the right amount of illumination can be focused directly on each critical work area. Positioning can be changed instantly to meet the seeing need. The various models of Localites solve the problem of providing each different type of precision job with the proper quantity and direction of light for the seeing task. Localites, in the right combination with general illuminating

FOSTORIA INDUSTRIAL

Specialists in Industrial Lighting for

THE FOSTORIA INDUSTRIAL
SERVICE FORMULA FOR
LIGHTING ON THE JOB



Careful Study of
Critical Work Areas

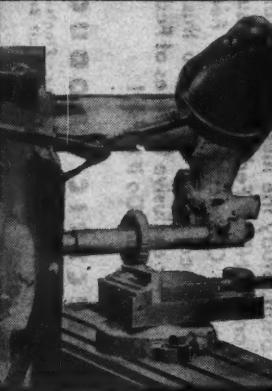


Determination of
Lighting Required



Recommendation of
Lighting Installation

OUR EMPLOYEES SEE BETTER AT TASKS THEY ARE DOING



LOCALITE Model 3267-C-172-SV

Directs up to 150 footcandles intense illumination on critical work. Used for large machine tools and similar equipment.

LOCALITE Model 3267-U-172

Concentrates up to 250 footcandles intense illumination on critical work. For small part assembly, inspection and precision machining.

GENERALITE Model 300

For larger area localized lighting. A highly efficient fluorescent unit with excellently designed shielding, operating and maintenance features.

surrounding areas, results in Balanced Lighting — the most efficient and economical method for industrial plant lighting.

For an analysis of your plant lighting, call one of the Fostoria Industrial Service Centers listed below. These qualified specialists in lighting for seeing will determine how best to help your employees see better the vital task they are doing.

REQUEST THIS FREE BOOKLET, TODAY



For complete facts on how Fostoria Balanced Lighting will improve and increase your production, write for this complete catalog and detail information on the advantages of Fostoria Industrial Lighting Service.

**Critical Work Area Lighting
ENGINEERED to the Seeing
Need of Each Worker's Task**



SERVICE Better Seeing



**SEEING THAT
= MATCHES THE
WORKER'S NEED**

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Independently Affiliated Manufacturers

Southern Industries, Atlanta, Ga.

Amalgamated Electric Corp., Ltd., Toronto, Canada

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620 Commonwealth Ave.
Commonwealth 0333

BUFFALO

404 North Oak St.
Lafayette 8135

CHATTANOOGA

1021 Chestnut St.

Phone 6-6194

CHICAGO

747 W. Jackson Blvd.

Randolph 5942

CLEVELAND

4500 Euclid Ave.
Endicott 6622

DAYTON

334 Wayne St.

Fulton 3594

DETROIT

12171 Grand River Ave.

Hogarth 1850

INDIANAPOLIS

548 Massachusetts Ave.

Riley 2934

LOS ANGELES

1206 Maple Ave.

Prospect 7761

MILWAUKEE

104 East Mason St.

Daly 2949

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Atlantic 7363

NEW HAVEN

(Hamden, Conn.)

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Worth 2-3352

OAKLAND

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Get that ball bearing action! The biggest single feature in starters and contactors—and you'll find it exclusively in Federal Noark Controls. You'll find the bearings smoothly and accurately locating and guiding the entire assembly. You'll find friction (always present where there is motion) reduced to an extremely low point. Study the illustration carefully. This is only ONE of Federal's many superior features. Contact your local Federal Field Engineer. He'll show you this and many other exclusive features of Federal Noark Controls. Do it today!

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BALL BEARINGS

The section in red represents the only moving part of the Federal Noark Magnetic Motor Starter. Simplicity itself!



Modern kitchen lighting is obtained from simple continuous strip, designed for end-to-end, or 90 degree angle mounting, to follow work area layout. Semi-indirect wall mounted two lamp unit provides ample light for dining alcove.

lamps are concealed behind the window valance. This highlights the draperies and adds an interesting decorative effect. A new pleasing design fluorescent ceiling fixture supplies soft general illumination throughout the room. Extra light for close work is furnished by portable incandescent lamps placed beside each seating unit.

The studio bedroom is provided with general illumination from an artistic ceiling fixture of lacy design, using fluorescent lamps. Additional general illumination, as well as an effective decorative touch, is available from fluorescent lamps concealed behind the window valance and above a book case. The lighted book case, adaptable in a living room, foyer or study as well as in the bedroom, achieves an unusual decorative effect through the use of a fluorescent lamp below the center shelf. A frosted glass panel located over the lamp permits a diffusion of light upwards, as well as providing ample light below.

Kitchen work areas are illuminated to approximately 30 footcandles by continuous strips of fluorescent lamps installed on the ceiling. Design of strip is such that individual units may be installed end-to-end, or at a 90 degree angle. A simple two lamp 20 watt wall bracket, open at top and with diffusing glass panel in angled side, supplies indirect general illumination, as well as direct lighting for a small breakfast alcove.

Fluorescent lamps and fixtures are used throughout in the bathroom. Soft, cool light is provided for the entire bathroom by an experimental type compact ceiling fixture. Light for shaving or applying make-up is provided by a

The Curtis Luminaire

NOW AVAILABLE IN VOLUME

FOR MAXIMUM INDIRECT LIGHTING EFFICIENCY!

SUPERIOR IN DESIGN, ENGINEERING . . . AND MANUFACTURE

The Curtis Eye-comfort Luminaire, Catalog No. 5090, is beautifully designed to give reasonably priced illumination to schools, offices, stores and other interiors.

The concealed "X-Ray" Silver Mirror Reflector is the secret of its high efficiency and low maintenance cost. For trouble-free lighting, specify Curtis standards of Quality, Engineering and Manufacture, which are built into every unit.

Sell Curtis Luminaire No. 5090 installations with assurance of prompt delivery in volume quantities. Write today for new specification sheet, Serial 2159.



CATALOG NO. 5090

STEM HANGER: Special self-aligning fitting in canopy assures plum hanging whether ceiling outlet is level or not.

CANOPY SWITCH: High edge canopy has knockout plug for pull switch. Switch and lamp bulbs are extra.

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MOTORS
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300
SERIES
TIME SWITCHES



● Telechron motors now bring a further improvement to Paragon 300 time switches . . . accurate,

rugged, dependable units for controlling signs, commercial lights, attic fans, stokers, oil burners, blowers, pumps, valves, motors, etc. Rotor and gear train sealed to exclude dirt and dust. Two bearing plate construction. Lower power consumption. Sealed-in-oil reservoir. Other important features.

NO PRIORITY NEEDED

Government restrictions have been removed from time switches. They may be purchased without priority rating.

WRITE FOR NEW BULLETIN . . .
giving complete details on the Telechron motored 300 series built by an organization of engineers and skilled craftsmen specializing in electrical equipment since 1905.

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Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

lamp installed vertically on each side of the bath room mirror. These long lines of light extend the full length of the mirror, which eliminates the shadows usually created under the chin by normal types of incandescent brackets.

flagged by making it the center of focus for functional layout and lighting. A circular cove surrounds the column, creating a sixteen foot soffit in the acoustic tile ceiling. This soffit mushrooms out from the center column with a hard plaster reflecting surface for the cove lighting located at the outer perimeter of the soffit.

FLUORESCENT COVE LIGHTING IN BEAUTY SALON

The Hutzler Brothers department store in Baltimore, Maryland, uses a progressive plan for modernization and remodelling. This plan is tied in with their expansion program.

One of the last areas to be remodelled before restrictions on use of building materials were put into effect by WPA, was the beauty salon and foyer, located on an upper floor of their nine story building.

Eleanor Le Maire, noted New York store designer, planned the interior for this remodelled area. Its architectural and decorative treatment follows the general modern trend used in other parts of the store which have been remodelled, and in new additions.

The foyer, shown in the accompanying photograph, is lighted very effectively with a combination of cold cathode fluorescent cove lighting and recessed louvered incandescent units. Each manicurist table is lighted with a neat design bracket, specially designed for this use.

A structural column located in the center of the room has been camouflaged by

Three circular tubes of 20 mm. cold cathode tubing, two in soft white and one in 3500 degree white, operating at 60 ma., are installed in the cove. This combination provides a very pleasing color quality of light, which, when reflected from the white ceiling, enhances skin tones of patrons and employees alike. This soft general lighting is supplemented by direct lighting from four 200 watt louvered reflector units which are installed in the soffit ceiling.

The bracket lights over manicurist tables use a half silvered tubular lamp which produces a good color quality of illumination for the operators in applying nail polish of various colors.

The salon uses the same lighting technique that has been employed for lighting throughout the store. Incandescent light sources concealed in louvered reflector units installed flush in the ceiling are depended upon for light for seeing, or light for selling. The color quality of light from lamps of 200 watt size or larger is ideally suited for this purpose. Cold cathode fluorescent tubing is used to provide a low level of general illumination, but more specifically to create decorative effects through the application of light and color to architectural detail.



Beauty salon foyer in Hutzler Bros. department store, Baltimore, Md. is lighted with combination of cold cathode fluorescent cove lighting and recessed louvered incandescent lighting.

For easier Sales and lasting Customer Satisfaction ..CERTIFIED BALLASTS



It's a fact! Your fixtures will have extra sales appeal for your customers . . . when you use Certified Ballasts. And good reason for this preference too, because:

1. **Certified Ballasts are built to definite specifications . . . to assure better lamp performance.** Leading fluorescent tube makers recognize this—since with Certified Ballasts in a fixture, they will guarantee lamp performance.
2. **Certified Ballasts are subject to thorough testing by Electrical Testing Laboratories, Inc., and Certified by them as meeting the specifications.**
3. **Certified Ballasts help assure top fixture performance and dependable service . . . as your customers know.**

Good reasons why you'll want this extra value and sales power . . . this assurance of continuing customer satisfaction for your fixtures!

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MAKERS OF BALLASTS FOR CERTIFIED FLUORESCENT LIGHTING FIXTURES
2116 KEITH BUILDING • CLEVELAND 15, OHIO



97%

**reported company age and reputation
most important buying factor!**

A number of commercial tape agents were recently asked to list the most important factors in the purchase of friction and rubber tape. Almost unanimously they reported the above results.

**On both these points, PANTHER and DRAGON
Friction and Rubber Tapes stand high**

They are made by a company in the electrical insulation business since 1878.

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PANTHER and DRAGON Friction Tapes adhere firmly and have high adhesive characteristics. PANTHER and DRAGON Rubber Tapes fuse readily and securely and have high elongation and excellent electrical qualities. All tapes pass ASTM and Federal Emergency Specifications.

For complete information on these tapes — or for the address of your nearest recognized distributor — write today.

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branch circuit coverage in 32A feed
branch circuit feed. This
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F. N. M. SQUIRES
Chief Inspector
New York Board of Fire Underwriters
New York, N. Y.

and
GLENN ROWELL
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

QUESTIONS ON THE CODE

REVAMPING AN OLD JQ8

Q. "I have a job of adding a few outlets and lights onto an old 110 volt 3 wire d-c installation on which I find that both wires of the branch circuits and also the neutrals on the service, mains and sub-mains, are fused.

"Will I have to go through the old work and remove the fuses in the neutral wires and polarize the old sockets?"—F.W.

A. If your work is done properly and the sockets which you install are polarized, there is no reason why your work would not be approved.

The inspector would probably request the owner to have the fuses removed from the neutrals of the service, mains and sub-mains, but probably would not ask that the fuses in the neutrals of the branch circuits be jumped nor that all the old work be polarized, although he would probably recommend it as a safety measure.—F.N.M.S.

ing switch must be rated in horsepower unless it supplies a 2 hp. or smaller load or more than a 50 hp. load. If the sum of the hp. or current ratings of the motors in question was 2 hp. or less, then you could have used a general use switch rated in amperes with a rating of twice the sum of the current ratings of the group of motors.—G.R.

WIRING A HAY MOW

Q. "On each farm wiring job it is necessary to place a hay mow light well above the level of the hay in the mow, and we have used conduit to protect the conductors for this outlet. Is it necessary to ground this conduit, and may it be grounded to the neutral conductor?"—H.S.

A. Usually the conduit extending A. through the hay mow can be less than 25 feet in length and when that is possible, it is not necessary to ground the conduit, providing it is so located that it will be beyond reach of persons or animals on or within reach of grounded surfaces. Where it is

within reach, the conduit will have to be either grounded with a separate grounding conductor or guarded against contact by persons or animals. See Section 2533. If the run is more than 25 feet in length, it will have to be grounded by a separate grounding conductor extending from the neutral bus in the service entrance switch to the conduit run. The Code does not permit grounding such a conduit to the neutral conductor of the individual circuit.—G.R.

UNDERGROUND SERVICE WIRING

Q. "Please advise me if there is anything in the National Electric Code which prohibits the use of 'trenchlay' cable for underground service wiring.

"The utility company has informed us that they have no objections to the use of this material."—R.C.

A. "Trenchlay" is a trade name for A. underground cable made by the General Cable Company and is used to designate several types of underground cable one of which is their service en-

SWITCH FOR MOTORS ON BENCH LATHES

Q. I recently was asked to run an additional circuit to supply five $\frac{1}{6}$ hp. 220 volt single phase motors driving small bench lathes in a single room. The circuit was taken from distribution cabinet which had ample capacity and a 30 ampere rated switch was used to control the circuit. Now I understand that I should have used a switch rated in horsepower instead of one rated in amperes. Can you explain this?—W.B.

A. Section 4410 of the N. E. Code requires that the disconnecting switch serving a group of motors have a rating not less than is required for a single motor whose rating equals the sum of the horsepowers or currents of all the motors of the group, and under Section 4402 we find that a disconnect-



PROMINENT IN TOLEDO'S electrical contracting fraternity are (L to R) C. F. Hammer, mgr., Toledo Chapter, NECA; W. N. Brown, Taylor Electric Co.; and Max and Jack Romanoff, Romanoff Electric Company.

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ARMORED CABLE • CRESFLEX • CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • BUILDING WIRE



Heavier loads for longer periods of time than formerly possible are obtainable with CRESCENT VARNISHED CAMBRIC CABLE, due to substantial improvements in high temperature varnished cambric tapes. This general-purpose, industrial power cable provides higher current carrying capacity for the same size of copper conductors, together with maximum safety and permanence.

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WIRE & CABLE

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

• IMPERIAL NEOPRENE JACKETED PORTABLE CABLES

trance cable—Type USE, and some of their ASE as approved for use underground.

Cables listed and labelled by Underwriters' Laboratories as USE and ASE* (note the asterisk mark), meet the National Code requirements for use on underground service wiring. Several manufacturers make one or both of these types.—F.N.M.S.

CABLE INSTALLED IN ATTICS

Q. "I have just been notified by the inspector that guard strips must be placed alongside Romex run over the floor joists of an attic reached through a small scuttle hole in a closet. The attic is not more than three feet in height and is not used to store things. Does the Code really require protection for the cables in such an instance?"—M.W.

A. Yes, all nonmetallic sheathed cables run across the face of floor joists, rafters or studs within six feet of the scuttle hole must be protected by substantial guard strips at least as high as the cable. In accessible attics reached by means of permanent stairs or ladders all cable within seven feet of the floor or floor joists must be protected if run across the face of studs, rafters or joists. See Section 3366 in the National Electrical Code.—G.R.

UNDERWRITERS APPROVAL

Q. "What is the difference between electrical equipment bearing the label of approval of the Underwriters and other equipment stamped U. L. re-examination service? Is the label attached only to equipment that is superior to that marked re-examination service?"—G.F.

A. While this is not strictly a Code question, there has been some misunderstanding concerning the various inspection services of the Underwriters Laboratories, Incorporated, due probably to the fact that few contractors are acquainted with the published listings of this organization which contain an explanation of these inspection services and the names and addresses of manufacturers of approved materials.

There are three forms of inspection service—label service, special service and re-examination service. The selection of the form of inspection service for any product rests with the Laboratories and it is governed, generally,

TRUMBULL L.V.D. BUSWAY

L.V.D. (Low Voltage Drop) BUSWAY
FOR MAIN FEEDER CIRCUITS
"PACKAGED"
POWER DISTRIBUTION

Trumbull Engineering pioneered the revolutionary idea of "packaged" power distribution systems . . . using standardized unit parts to assemble main "electrical highways" for the distribution of power in industry.

Standardized prefabricated 10 ft. sections are bolted together at the customer's plant, protected by a cover and easily and rapidly installed with the necessary accessories and hangers . . . all available in packages ready for prompt factory shipment.

The "airated" construction of Busway protective covers provides ample vents for sufficient airflow to approximate closely the ratings of the same Bus Bars in air.

Vitally important are the Trumbull design features that enable LVD Busway to withstand the high short circuit stresses which may be encountered in modern industrial production. Also, the holding of impedance values to the very minimum through the configuration of close spacing and interlacing of phase bars on multiple bar assemblies. Bus Bars are insulated with heavy layers of "fire-stop" impregnated tape . . . water and moisture proof . . . impervious to dust and other foreign matter.

From every point of view Trumbull LVD Busway is a thoroughly dependable system . . . correct in design, mechanically and electrically . . . safe, space saving, flexible, adaptable and practically 100% salvable . . . meeting the strictest specifications for electrical modernization needs. Its unfailing performance in many of the nation's largest and most vitally important war plants forecasts a wide acceptance for peacetime production.

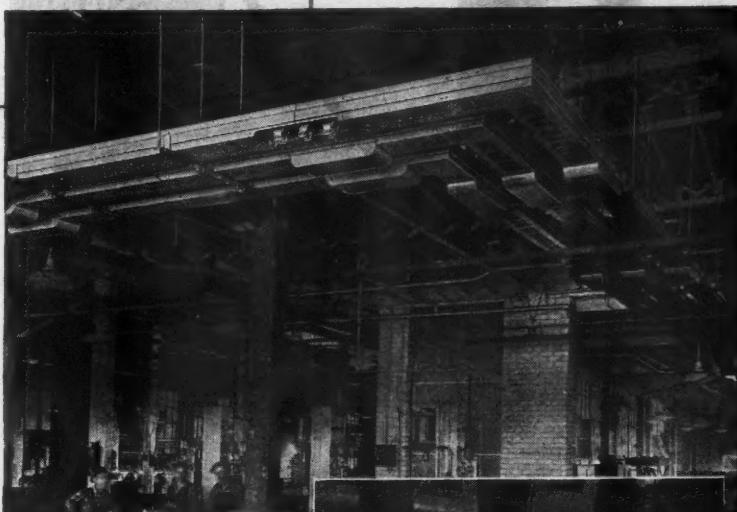
Full details on request.

Capacity: up to 600 V AC, 400 to 2000 amperes; 2, 3, 4 pole, 3 phase 4 wire.

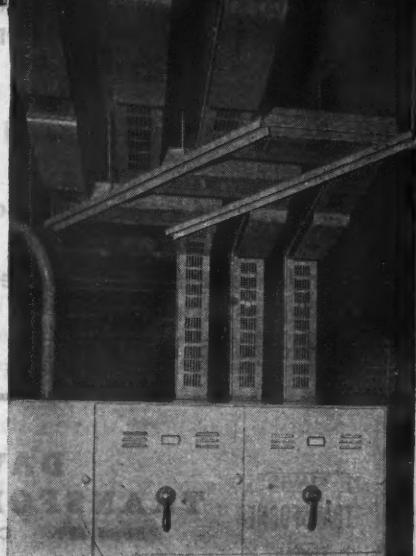
THE TRUMBULL ELECTRIC MANUFACTURING CO.

OTHER FACTORIES AT NORWOOD (CINN.) O.
SEATTLE — SAN FRANCISCO — LOS ANGELES

Below: Three parallel runs of 1350 ampere LVD Busway in the Bode-Cummins Mfg. Co., Louisville, Ky., passing through the plant from the switchboard shown below.



Right: Circuit Breaker Switchboard from which the three runs of LVD Busway shown above are controlled.

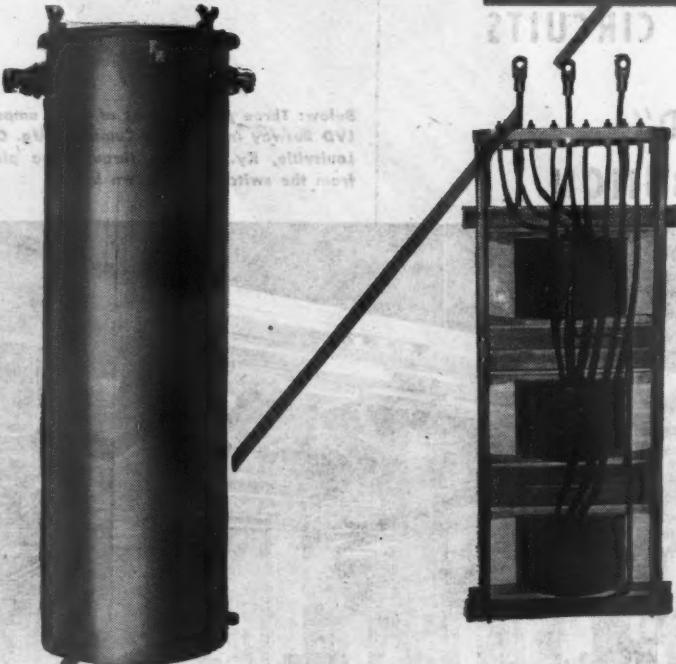


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DAVIS Three Phase Distribution Transformers Rated 100 KVA, 13,800 Volts and Below.
Built to E.E.I. and NEMA Specifications.

- Improved appearance
- Saves almost 70% of space required by separate single-phase units
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by the type of service already established for the class of the product in question. These different forms of inspection service were originally found necessary to fit the various types of products submitted for Laboratory approval and are not intended to reflect grading or quality in any manner. Products labeled or listed are not necessarily equivalent in quality or merit, as any means of designating Laboratory approval simply means compliance with minimum specified requirements adopted as standards by the Underwriters Laboratories, Incorporated.—G.R.

YAW268 860100 (100) D.V.I.

TO FUSE OR NOT TO FUSE

Q. "I am replacing a two wire entrance (service) which has two fuse branch blocks with a three wire entrance.

"The Inspector tells me the neutral must be solid because the wiring system is armored cable, a continuous underground system is available for ground and it is being fed from a system that has a secondary ground at the transformer.

"The same condition existed before on the two wire system and the neutral was fused, except it was fed from a master service. Is 2409b applicable then and is that the answer to the controversy?

"Relative to 2409b does the condition of grounding mean a condition where there is no underground water system? What is meant by the likelihood of reversal of connection warrants? Would a building like the above fed from a master service, come under that category?"—B.D.

A. 2409b does not necessarily apply only where an underground water piping system is available. In general the presence of a water pipe ground would tend to eliminate the "likelihood of reversal of connection" but maybe not always so. 2409b does mean that where a likelihood of reversal of connection does exist the inspection authority may, if it sees fit, require that the final two wire branch circuits be fused in both wires.

The code does, however, require that grounded neutrals be not fused. This, however, was a change in the code rules some time ago and when changes are made to the Code the new rule is not retroactive so as to require that installations which have been approved under a previous rule be altered to meet the new requirements.

On the other hand, the removal of a fuse in the neutral is so simple and the blowing of a neutral fuse on an unbalanced circuit is so productive of

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Tomorrow's Better Door Chimes

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hazards that the request to eliminate fuses in the neutral is quite justified. (The opening of a neutral connection which produced a condition similar to the blowing of neutral fuse just recently resulted in a \$2,000,000 loss.)

The likelihood of reversal has been experienced in the past chiefly in rural areas by reversals in pole line or service connection due generally to faulty or hasty testing before making connections. Lack of good grounding connections has often resulted in wrong connections. In these cases a good water pipe ground would probably have lessened the possibility of the wrong connection.

In the writer's territory we have been requiring the removal of neutral fuses on services and mains and sub-mains where we have run across them and have permitted the fuses to be made solid on branch circuits if it was so desired because we feel the conditions here render it unlikely that the connections will be reversed. We have not, however, on those old jobs required that the old work be all gone over to effect a thorough polarization of sockets and switch legs although we strongly recommend it and generally get it.

Of course inspection authority having jurisdiction has the final disposition of the matter.—F.N.M.S.

SN WIRE IN METAL SURFACE RACEWAY

Q. "I am interested in obtaining information on the use of SN wire and Wiremold.

"At present the code makes a concession or allows more No. 14 SN wire in conduit than rubber covered wires, therefore it would appear that more SN wires could be installed in Wiremold than the allowable number of rubber covered wires. Will you kindly advise me on this?"—M.K.

A. The number of wires permitted in any size of the raceway mentioned would be the same for synthetic Type SN as the number of rubber covered wires permitted in the same size of the raceway. Also the number of wires of either the rubber covered type or of the synthetic insulation type must not exceed ten inasmuch as that is the maximum number of wires permitted in the largest size of that raceway.

The limitation is based not only on the amount of space occupied by the wires and by the heating effect, but also by the carrying capacity of the raceway itself and therefore the ability of the raceway to assure the opening of the fuse or fuses protecting the

wires in the raceway in case of a ground fault.
For instance with the type of raceway mentioned, and in the larger size, limit is still ten wires although there may be room in the raceway for about 30 or 40 wires. If the raceway were made of heavier gauge metal so that it could be listed as a wireway, then the limit of wires could be raised above the present limit of ten.—F.N.M.S.

CONNECTIONS TO TERMINALS

Q. Does the Code make it mandatory to solder the individual conductors of wires or cables before they can be fastened in a set screw type terminal fitting?—M.C.K.

A. Not necessarily. The N. E. Code under Section 1116 requires that the connection of conductors to terminal parts shall insure a thoroughly good connection without damage to the conductors. This really means that the authority enforcing the Code must decide whether or not it might be necessary to use solder or some other means of preventing injury to the conductor or to assure a good connection.—G.R.

FLUORESCENT FIXTURES

Q. I have been asked to install a job in which No. 10 wires are run from a multi-breaker panel equipped with 25 amp. breakers to outlets on which I am to hang two lamp 40 watt fluorescent fixtures. How many of these fixtures can I put on each circuit?—W.M.

A. Inasmuch as the fixtures on this job utilize fluorescent tubes but not the Mogul bi-post tube holders, the branch circuits are limited to the 15 ampere class and the load on each circuit is limited to either 12 amp. or 15 amp. according to the nature of the load. If the load is "continuous", such as for store lighting or similar loads, as for factory lighting where the lights are all on for periods of over three hours, the load is limited by Section 2107 of the Code to 80 percent of the branch circuit rating, which of course for 15 ampere branch circuits, is 12 amperes.

It will be noted from the above that the 25 amp. multi-breakers cannot be used for the protection of the 15 ampere branch circuits. Either they would have to be changed to 15 amp. breakers or additional protective devices of 15 amp. placed between them and the load.—F.N.M.S.

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How Rocket Powder is Heated 144 Times Faster With RCA Electron Tubes

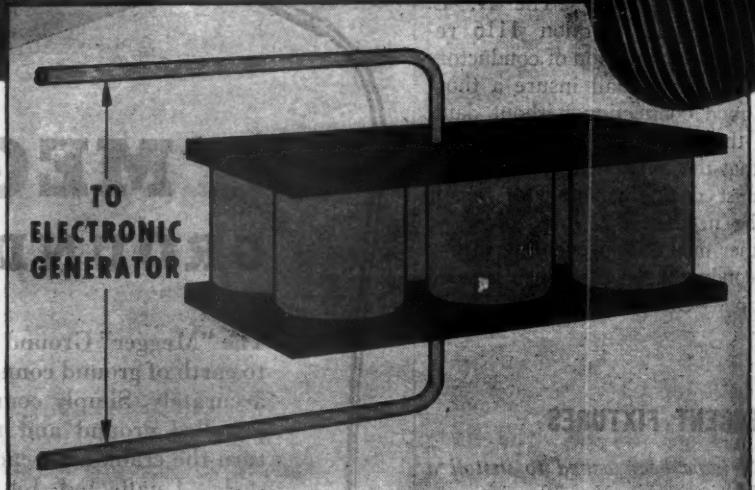
Electronic Heat Cuts Heating Time from 24 Hours to 10 Minutes

The Problem: Rocket propellant charges are molded into the desired cross-section form (circle, cross, etc.) by forcing the material through correctly shaped dies. These extrusions are then cut to specified lengths. Before molding, the powder-mix must be accurately and uniformly heated — *without overheating or underheating any portions.*

Original Method: Mix was heated in an oven, usually while in cylindrical rolls about 10" in diameter. The time required to meet temperature specifications varied from 12 to 48 hours.

The Electronic Method: Rolls are placed between flat metal plates. High-frequency power, provided by RCA Electron Tubes, passes from plate to plate through the rolls, generating heat *within the powder* and heating it uniformly all the way through in less than 10 minutes—144 times faster on the average than the old method.

How It Works: Power for this process comes from standard RCA electronic generators, each of which is rated at 15,000 watts out-



R-F power passing between plates and through powder generates heat

Advantages of Electronic Heating of Non-Conductive Materials: Electronic heat can be controlled precisely. Heating is instantaneous when the power is applied, and stops instantly when the power is shut off.

General Advantages: Because there is no variation of temperature throughout the material, warping is minimized. Since heat is generated directly in the material to be heated, there is no warm-up time, and no heat is wasted as in the case of ovens, furnaces, steam-platens, and other heat-transfer devices.

With materials, such as thermosetting plastics, that set with the application of high temperature, the quick heating possible with electronic heating permits greater workability and results in fewer rejects. Production-line techniques can be employed, cutting processing time from

days or hours to minutes—in some cases to seconds.

Turn to Electronics for Solution of Your Own Problems: If you are interested in electronic heating, write to **RADIO CORPORATION OF AMERICA**, Electronic Apparatus Section, Camden, N. J., Dept. T.

Electron tubes are providing a practical solution to hundreds of diversified manufacturing problems—process-control, machine-control, heat-treating of metals, plant-protection, and a host of others. Consult with RCA tube-application engineers for information or advice on possible applications of your own. For examples of some of the present-day uses of tubes send for the free booklet, "16 Examples of RCA Electron Tubes at Work in Industry." Write to **RCA**, Commercial Engineering Dept., Section 62-58S, Harrison, N. J.



15-kw RCA Electronic Generator provides power for powder drying

put. These units are simply electron-tube oscillators (similar to those in radio transmitters), which change 60-cycle commercial power into power at a frequency of approximately 10 million cycles per second. When this high-frequency power is passed through a dielectric (non-conducting material), such as the powder, it instantly generates heat uniformly throughout the material.

THE FOUNTAINHEAD OF MODERN TUBE DEVELOPMENT IS RCA



PRACTICAL ARTICLES on the application, installation and maintenance of electronic apparatus in industry. Readers are invited to contribute items from their experience to this department. Articles used will be paid for.

ELECTRONICS

Installing, Maintaining, and Servicing Electronic Temperature Control Systems

THE G-E Reactrol system consists of an electronic control used in conjunction with saturable core reactors and a temperature control instrument to automatically regulate the power input to an electrically heated furnace or process so as to maintain a preset temperature in the furnace or process. This article will discuss the installation, maintenance, and servicing of this particular system.

The Reactrol system is a true input control, since there is a continuous flow of power, accurately adjusted to the immediate requirements of the electrical heating units. In this respect, this system differs from so-called input controls that regulate power by alternately applying full voltage and no voltage to the electrical heating units. Such so-called input controls regulate average power input but not the instantaneous input, because when full voltage is applied to the heating units they dissipate full power.

The apparatus in a typical installation consists of five essential parts: the furnace or process, the temperature of which is to be controlled; one or more saturable core reactors whose a-c windings are connected in series with the electrical heating units in the furnace or process; an electronic panel which controls the amount of direct-current in the d-c windings of the saturable core reactors; a thermocouple in the furnace or process; and a temperature control instrument which is connected to the thermocouple and to the electronic control panel. Fig. 1 is a schematic diagram in which these five parts are shown.

Since the electronic control equipment, temperature control instrument, and other apparatus must be properly chosen to meet the requirements of

E. D. Schneider
Industrial Control Engineering Division,
General Electric Company
Schenectady, N. Y.

each particular furnace or process, remarks and suggestions of only a general nature regarding installation, operation, maintenance, and servicing can be given here.

Before the installation of the apparatus is begun, instruction books, wiring diagrams, and outlines covering each piece of equipment should be obtained from the manufacturer. This information should be carefully read and understood by each person responsible for installing, operating, maintaining, and servicing the equipment.

If adequate instruction books and drawings cannot be obtained, or if essential information is lacking and qualified personnel is not available,

the manufacturer should be contacted and the required assistance obtained.

The reasons for this procedure obviously are to assure that the equipment is properly installed, put in service, operated, and maintained, and protected from damage by inexperienced or misguided personnel.

The installation should be carefully planned so the work will proceed with minimum confusion. The apparatus should be located with respect to the furnace in accordance with drawings, if complete installation drawings have been prepared. Otherwise, locate the apparatus so that it meets the requirements of the operating, maintenance, and service departments and complies with sound engineering principles. Figs. 2, 3, 4 and 5 illustrate typical installations of this equipment.

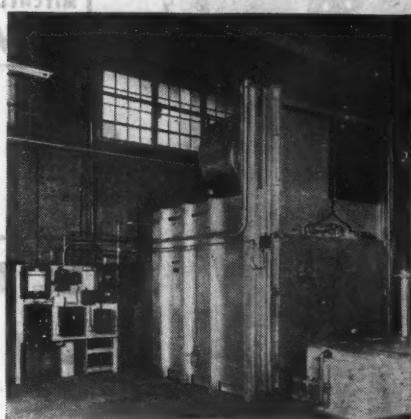


Fig. 2—Box-type electric furnace with air recirculation, water quench tank, and Reactrol system. This system consists of electronic control panel, temperature control instrument, transformers, saturable reactors, and switches installed on panel to left of furnace.

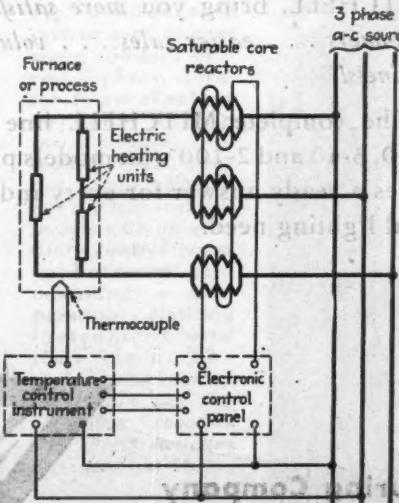


Fig. 1—Schematic diagram of principal parts in a typical installation.

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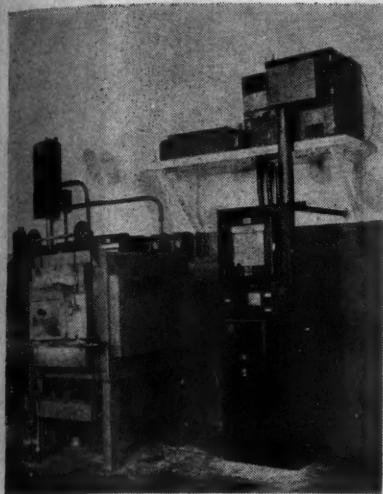


Fig. 3—Box-type electric furnace used with Reactrol system. Reactrol system consists of panel at right of furnace and saturable reactor and transformer on the shelf above the panel.

unpacked to avoid marring the enclosures or damaging the apparatus. Particular care should be exercised that no small parts are mislaid or thrown away with the packing material. If the equipment is not to be used where it is unpacked, it should be stored in a dry place and protected from accidental damage.

During shipment, the control relays and devices have their armatures or moving parts blocked or tied so as to be immovable. Remove this blocking and observe that the parts move freely and without undue friction or binding.

As a matter of precaution, do not unpack the tubes until the equipment has been completely set up and connected and power is available. Then remove the tubes carefully from their cartons and wrappings. Save the instruction sheets which are wrapped around the thyratron and phanotron tubes, and record the installation date and serial number on that portion of the sheet which is to be used when a tube is to be returned to the factory. If a tube has been unpacked before it is to be used, repack it in its original carton for safe keeping. Avoid dropping a tube or placing it where it would fall or be accidentally knocked over. Reasonable care in handling these tubes will be amply repaid in lengthened tube life.

If a new furnace or process is to be installed, this should be done in accordance with the manufacturer's drawings and instructions. Special precautions should be taken that all safety and protective devices are properly installed.

The saturable core reactors may be mounted in any convenient location

where they will be subject to free circulation of air, for cooling purposes. It is important, however, that they should be located so that all power connections are short and arranged to give minimum resistive and reactive voltage drops in the power connections. The Thyrite resistor should be located so that the connections between it and the d-c windings of the saturable reactors are as short as possible.

The electronic control panel and temperature control instrument may be located in any convenient place provided:

1. It is reasonably free from dirt and grease and entirely free from corrosive gases or vapors—unless, of course, adequate enclosures have been included for protecting the apparatus.

2. It is free from vibration. This is especially important with regard to the temperature control instrument because erratic operation will result if it is subjected to vibration.

3. It allows the temperature control instrument and electronic control panel to be close together and at a convenient height for ease in operation and servicing.

- 4: It supplies adequate clearance for a person to work around the equipment.

The power-supply voltage and frequency should agree with the nameplate rating of the panel, control transformers, etc. If certain devices are to be energized from control transformers that are connected to the power supply, check the nameplate rating of these transformers to be sure that the secondary voltages are correct. These points should be carefully checked. It is also important that the power supply should be capable of maintaining rated

voltage to within plus or minus five percent.

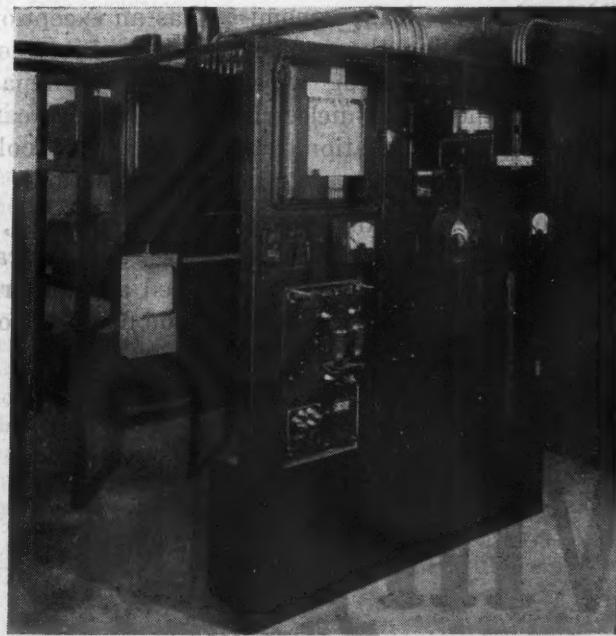
Ratings of Saturable Reactors and Anode Transformer

The nameplate rating of the saturable reactor or reactors should be checked. A saturable reactor really has two ratings—the rating of the a-c winding and the rating of the d-c winding. The a-c rating includes the frequency, a-c voltage, and kva. ratings. The frequency rating should correspond to the power-supply frequency. The a-c voltage rating corresponds to the maximum a-c voltage which can be impressed across the a-c winding. On single-phase, this is equal to the a-c line voltage connected in series with the load and saturable reactor. On three-phase, when three saturable reactors and loads are connected as shown in Fig. 1, the a-c voltage rating should correspond to the a-c line-to-line voltage divided by 1.73.

For unity power factor loads it is common practice to specify the total kva. rating of saturable reactors as being equal to the total kw. of their associated load. Hence a 75-kw., single-phase load uses a 75-kva., single-phase saturable reactor. A 75-kw., balanced, three-phase load, however, uses three 25-kva. saturable core reactors.

Because of the fact that saturable core reactors have some impedance even when carrying full saturating d-c, the maximum voltage available for the load resistor is 93 percent of the line voltage applied to the saturable reactors and their series loads. Hence the load resistor (often called heating unit) is designed for full kw. at 93 percent of line volts.

Fig. 4—Reactrol system used to control a 158-kw., 440-volt, 3-phase, elevator type electric furnace having two separately controlled 79-kw. heating zones. Shown are the two Reactrol panels with an auxiliary control panel in between and mounting a temperature-limiting instrument and time clock. The rack in the rear of the panel has the saturable reactors and safety switches mounted on it.





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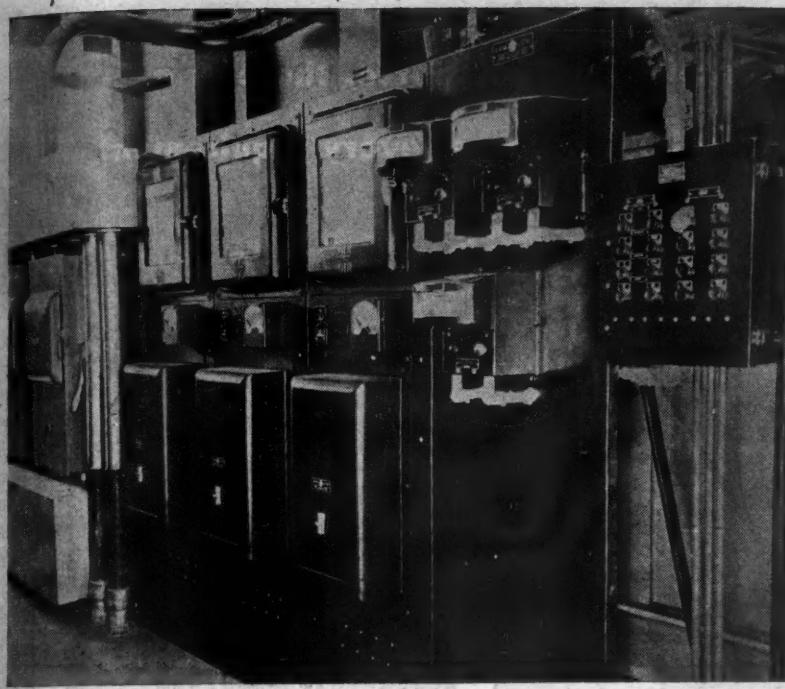


Fig. 5—Reactrol system for a roller-hearth electric furnace having three heating zones. The panels at right of reactrol panels mount temperature-limiting instruments and pushbuttons for operating the furnace door.

The maximum a-c for which the saturable reactor has been designed can be determined by dividing the kva. rating by 93 percent of the a-c voltage rating and multiplying by 1000.

The minimum possible a-c through a saturable reactor occurs when no d-c flows through its d-c coil. The actual value of the minimum a-c is primarily determined by the design of the reactors. For use with heating loads, two designs have been standardized. One design has a minimum current of 22 percent of normal rated current and is referred to as a five percent minimum power design, since the 22 percent current flowing through the load resistor will dissipate five percent of normal rated kw. in the load resistor. In similar manner, the second design has a minimum current of ten percent and is referred to as a one percent minimum power reactor.

The d-c in the d-c windings of the saturable core reactors is obtained by the rectifying action of the thyratron and phanotron tubes converting the a-c anode voltage into a d-c voltage. The a-c anode voltage comes either from an anode transformer or the a-c lines.

The d-c rating usually includes the d-c voltage rating and the d-c current rating. The d-c ratings correspond to full saturation of the d-c winding. They give information from which the required value of anode voltage and size of the anode transformer can be determined.

The required anode voltage is given by the following:

$$\text{anode voltage (RMS)} = \frac{\text{Total d-c voltage} + 20}{0.45}$$

The total d-c voltage is the nameplate rating for a single reactor on single-phase. If two or more reactors are used with d-c windings in series, the total d-c voltage required is the sum of the d-c voltage ratings of these windings.

If an insulating type anode transformer is used, its size should be equal to or greater than the kva. calculated from the following:

$$\text{kva} = \frac{1.25 \times 0.707 \times \text{d-c current}}{1000} \times \text{anode voltage (RMS)}$$

The value of the d-c is given on the nameplate of the saturable core reactor.

If the anode transformer is of the auto type, its size can be smaller and will depend upon input and output voltages and the kva. calculated above.

As an example of the use of the above relations in determining the a-c current rating of a saturable reactor and the rating of an anode transformer, consider the system shown in Fig. 6. Assume the line voltage is 460 volts, 60 cycles. Also assume the nameplate of the saturable reactor contains the following:

A-C winding: 75 kva., 460 volts, 60 cycles.

D-C winding: 83 volts d-c, 3.5 amps., d-c.

The calculations would be as follows:

Max. a-c load current

$$= \frac{75 \times 1000}{.93 \times 460} = 175 \text{ amps.}$$

Anode voltage (rms)

$$= \frac{83 + 20}{0.45} = 230 \text{ volts}$$

Anode transf. kva. =

$$\frac{1.25 \times 0.707 \times 3.5 \times 230}{1000} = 0.712 \text{ kva. min.}$$

The actual rating of the anode transformer would probably be 0.75 kva., which is a standard size transformer. The complete rating of the anode transformer would be as follows: 0.75 kva., 60 cycles, 460 volts primary, 230 volts secondary.

Connections

All power and control connections should be made according to the interconnection wiring diagram. Special precautions should be taken to:

1. Maintain phase relationships shown on wiring diagram and also to observe the polarities of all transformers as indicated.

2. Make power connections so that resistive and reactive voltage drops in them will be a minimum. This requirement can be met best by locating the apparatus requiring power connections so that connections will be short, power wires of adequate size are used, and wires carrying single or three-phase power be grouped together as close as practical.

3. Locate control wiring with respect to power connections so that the mutual inductance between them will be a minimum. This means that control connections should be located apart from the power connections. Control connections should not be placed in the same conduit with power connections unless space limitations makes it absolutely necessary.

Note: When input and/or output connecting wires are run in iron conduits, it is necessary to run the incoming and outgoing wires of a pair or group in the same conduit to avoid induced currents and heating losses in the sheath. Also avoid having currents come in through one conduit and out through another.

4. Solidly ground the electronic control panel, the cases of the saturable reactors, all conduits, and the cases of all externally mounted devices.

Suggestions regarding temperature control instruments and associated parts are listed below:

1. These instruments are delicate and should be handled with care.

2. Locate the instrument near the electronic control panel.

3. Avoid locating the instrument

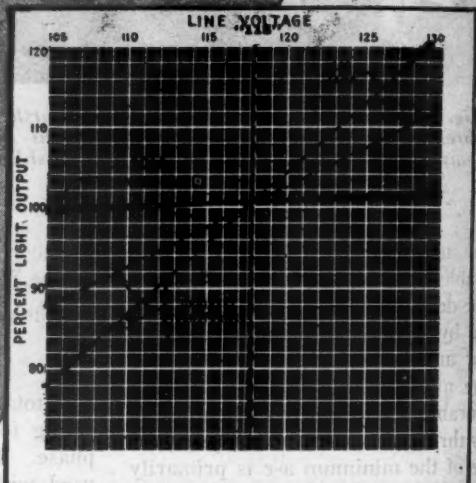
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COLD CATHODE	Bulletin	JCC-107
FLUORESCENT	Bulletin	JCC-108
FLUORESCENT	Bulletin	JCC-110

where it might be subject to vibration and shock, corrosive gases and vapors, and dirt and dust.

4. Follow instructions furnished by manufacturer.

5. If possible, call in representative from manufacturer before starting.

6. Choose type of controlling thermocouple and locate it in such manner as to have quick response to temperature changes.

7. After instrument has been installed and operating, it should be left alone except for periodic maintenance recommended by the manufacturer.

8. Over-temperature protection should be provided. This may be done in several ways:

a. By the use of an over-temperature contact in the temperature control instrument which opens and shuts down the equipment if the temperature exceeds the setting of the contact.

b. By use of a separate over-temperature instrument or device.

c. By use of an over-temperature fuse located in the furnace or process.

Putting in Service and Operation

The first and most important factor for the starting and operating of a furnace or process is that all persons responsible for the successful operation of the entire system should thoroughly understand not only the functioning of the individual parts of the system, but to understand to the best of their ability the interrelated functioning of all of the parts. Often it is not easy to gain a complete and thorough understanding of an entire system. Some furnaces and most processes have features which make their operation different from any other system. The instruction books usually furnished cover the devices and parts in quite complete detail. Very seldom are instruction books available which cover every phase of the entire system, and, unfortunately, such a book cannot usually be written until an installation has been completed and in successful operation.

After the installation and connections have been completed, a thorough check of all devices and connections should be made. The following check list may be helpful:

1. Has the blocking which was used to hold moving parts of relays, contactors, and other devices stationary during shipment been removed, and do those parts now operate freely?

2. Have all tools, temporary material, loose wires, etc., which might interfere with operation, been removed?

3. Have all packing materials, temporary structures not actually required, and surplus materials been removed? The area in the vicinity of the installation should be cleared of debris and dirt.

4. Check all connections to see that they are secure.

5. Compare all connections made during the installation with the wiring diagram. Particular care should be given to the phasing of all transformers and phase relation of connections shown on the wiring diagrams.

6. Check the devices to see that they are connected for the voltage at which they are to operate. For example, the electronic control panel may be designed for use on several voltages, but it may be necessary to make changes in it to correspond to the voltage at which it is to operate.

7. Check the sizes of all fuses to see that they are as specified.

8. Install tubes in electronic equipment as directed in the instruction book.

The general procedure to follow when putting the equipment into operation is to apply power to the devices individually, in accordance with the directions contained in the instruction books. In this way it is possible to determine whether or not the devices are functioning correctly. Reduced power should be applied to the furnace or process for the prescribed time to allow for initial heating and baking out. During this initial period, particular care and observation will be required to detect any over-heating or other improper functioning of any of the parts or devices. Safety devices, limit switches, and protective features should also be checked.

The instruction books supplied with the electronic control panel will usually describe in detail the method of making initial adjustments of potentiometers on the panel, the precautions and preheating period required when putting the tubes in operation, and a prescribed order to follow in making adjustments on the panel after it has been put in operation.

The instruction book supplied with the temperature control instrument will usually describe in detail the initial adjustments of the instrument, and the procedure to follow when putting it in operation.

It is usually preferable to start the equipment with the temperature setting pointer of the temperature control instrument set at a low temperature. After power is applied to the system, carefully watch the heating units, if possible. Also carefully watch the voltmeters or ammeters that were

furnished with the equipment and watch the rise in temperature as indicated on the temperature control instrument.

When the temperature of the furnace or process reaches the preset value, re-adjust the controls as required to obtain stable operation. After stable operation at the low temperature has been obtained, gradually raise the temperature by advancing the temperature setting. The temperature of the furnace or process should gradually increase and stabilize close to the new preset value.

Adjustments are usually provided on either the electronic control panel, the temperature control instrument, or both, for adjusting the system to obtain optimum performance. When these adjustments have been properly made, the system should respond to temperature variations or load variations in the furnace or process with a minimum of overshooting or hunting consistent with sufficient liveliness or speed of response. The actual performance of the system will depend upon many factors.

A convenient standard of performance for a temperature control system is the way in which the actual temperature varies when the temperature setting of the instrument is changed suddenly. Normally the actual temperature will oscillate about the new preset temperature following the change of setting. Experience has proved that the most optimum performance is obtained if the temperature oscillates with a decreasing amplitude, so that the amplitude of the second over-swing is about 25 percent of the amplitude of the first over-swing (Fig. 7). Once this condition has been obtained, it can be concluded that the adjustments on the electronic control panel and the temperature control instrument are properly made.

The equipment should operate for a long time with but little attention, because there are few moving parts and

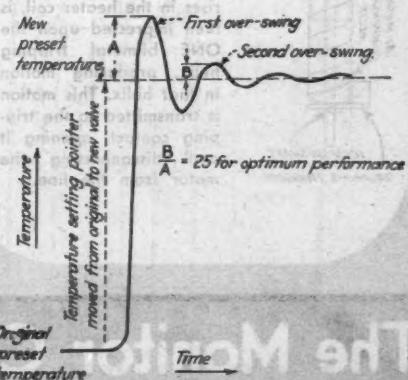


Fig. 7—Temperature vs. time curve resulting from a sudden change of temperature setting.



big

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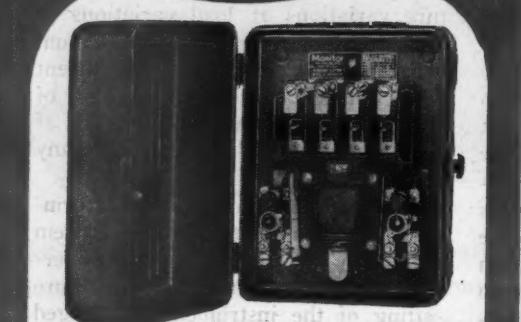
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The Monitor Controller Company

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therefore only a few parts which will require a replacement due to mechanical wear. It is advisable, however, to inspect the moving parts periodically so they can be replaced before any breakdown occurs. Lubricate mechanisms and moving parts only as called for in instruction books for the particular devices.

An important item in any maintenance program is that of keeping the equipment clean. Clean equipment is always easier to service than dirty equipment. A periodic cleaning may reveal conditions which if not corrected could result in a failure of the equipment and a shutdown.

The instruction book supplied with the temperature control instrument will usually contain a section on maintaining the instrument. If such an instruction book is not available, it is advisable to order the required books from the manufacturer of the instrument. When ordering such books be sure to give complete description of the instrument including information marked on its nameplate, the type and model numbers, serial number, etc., to assist the manufacturer in supplying the correct books.

The maintenance of many temperature control instruments usually includes some or all of the following:

1. Lubricating the mechanisms in accordance with instructions for the instrument.

2. Replacing recorder charts.

3. Filling recorder fountain pen with ink.

4. Renewing dry cell batteries.

5. Cleaning the mechanisms in accordance with instructions for the instrument.

6. Inspecting contacts and slide wires to make sure contacts are clean, have adequate wipe and clearance, and pigtail connections are not worn.

7. Checking screws and nuts on mechanism and binding screws on terminal boards for tightness.

Inspect the thermocouple or temperature-detecting means periodically to note any possible deterioration because of temperature or gas atmosphere used in the furnace or process. If a protecting tube is used for the thermocouple, examine it for flaws or deterioration. Note the condition of the special connection wires between the temperature-detecting means and the temperature control instrument. Defective or potentially defective parts should be replaced.

Safety and protective devices such as limit switches, overload relays, and over-temperature contacts or instruments should be checked at regular intervals. Over-temperature devices can be checked by slowly raising the temperature of the furnace or process and noting the temperature at which the device operates. If the devices fail to function at their preset values, they should be repaired and put in operating condition without further delay,

because their failure to operate may result in a serious damage to the equipment or injury to the personnel operating the machine.

Check all electrical connections periodically. Make sure all binding screws on terminal boards are tight. Connections may become loose, especially if vibration is present.

Feel the cases of the transformers and saturable reactors and if questionable, check with a thermometer to determine whether there are any abnormal increases in temperature. Signs of smoke or the odor of burning insulation around the electrical equipment may indicate overload conditions or other impending failure.

The tubes used in the electronic equipment normally will give long, continuous service. In order to maintain continuous and uninterrupted operation, it is advisable to test the tubes at least once a year. Most vacuum tubes can be tested on a radio tube tester. Facilities for testing thyratron and phanotron tubes are not so readily available, so it may be necessary to make arrangements with the manufacturer for testing these tubes. Tubes whose electron emission has fallen below normal, or which indicate that they are approaching the end of their useful life should be replaced. Spare tubes should be kept available at all times.

The servicing of the equipment usually requires the use of certain

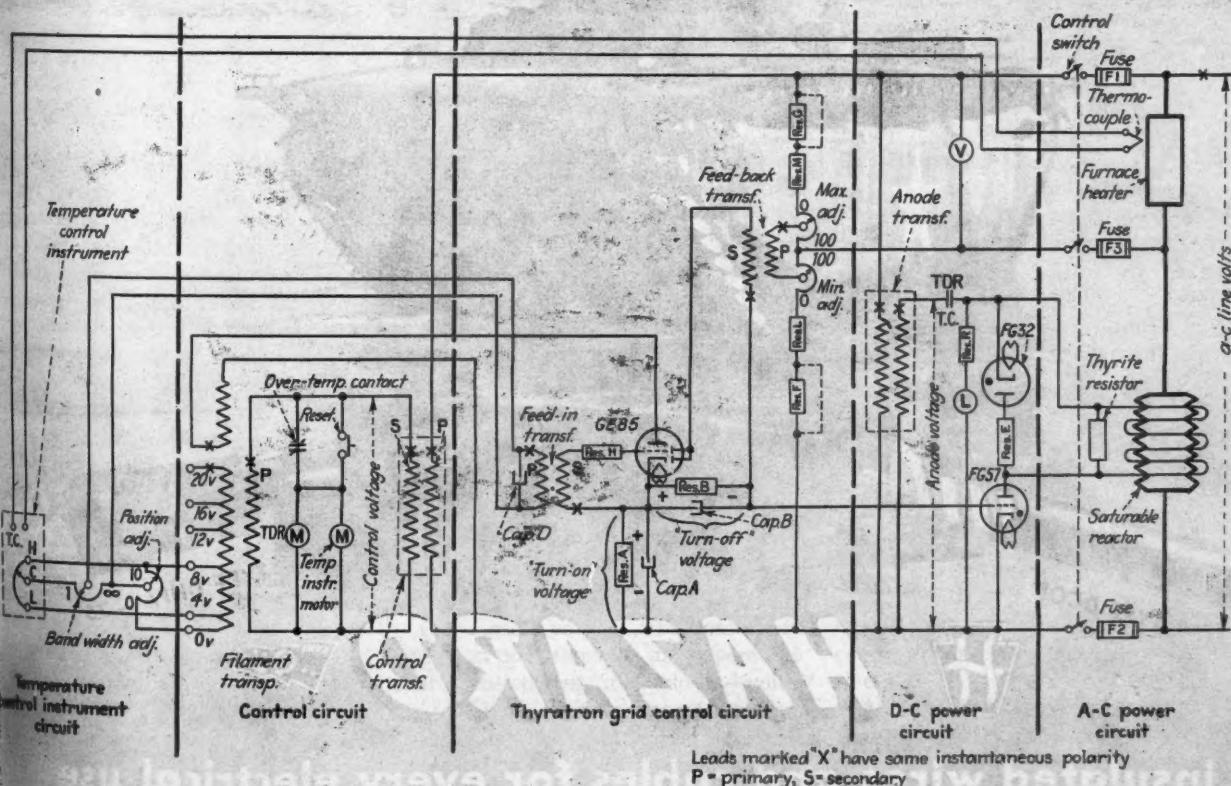


Fig. 6—Elementary diagram of typical electronic temperature control system.

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Like prehistoric monsters emerging from the sea, the famous "water buffalos" spearhead the assaults on Jap-held Pacific Islands, carrying the first attack wave up the beach and into land combat.

One of our wartime jobs has been to supply electric wires and cables that operate the gun turrets, supply the lighting and connect the control instruments on the "water buffalos". And similar Hazard marine cables —millions of feet of them — are installed in the cargo vessels that take the "buffalos" across the ocean and in the convoying warships that support their landing. Two of the sturdy electric cables used on the "water buffalo" are shown here.

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test instruments. A multimeter, a vacuum tube voltmeter, and a cathode-ray oscilloscope are the instruments best suited for servicing the electronic control panel. The method of servicing and the location of trouble in an electronic control panel can best be illustrated by considering a panel in a typical installation (Fig. 6). It will be seen that this system consists of five essential parts: a-c power circuit, d-c power circuit, thyatron grid control circuit, control circuit, and temperature control instrument circuit.

The a-c power circuit consists of the furnace heater and the a-c winding of the saturable core reactor in series with the a-c line. The d-c power circuit consists of the FG57 thyatron, FG32 phanotron, anode transformer, d-c winding of the saturable reactor, contact on time delay relay, and, in some cases, an indicating light.

The thyatron grid control circuit comprises the GE85 diode-triode tube, maximum and minimum adjustments with their associated current limiting resistors, feed-back transformer, and feed-in transformer. Also included are the capacitor-resistor combinations across which appears the "turn-on" and "turn-off" voltages which are in series with the grid-cathode circuit of the FG57 thyatron.

The control circuit consists of a control transformer, filament transformer, time delay relay, reset button, and over-temperature contact and temperature instrument motor actually located in the temperature control instrument.

Before proceeding with a discussion of shooting trouble, a brief explanation of the operation of this system will be given.

It should be remembered that the primary function of the system is to regulate automatically the power input to the furnace heaters to maintain the furnace at a desired temperature. This is accomplished by means of the closed-cycle control system in which the thermocouple in the furnace develops a minute voltage which is approximately proportional to the furnace temperature. This minute voltage is in effect amplified by the mechanism or circuit in the temperature control instrument to such an extent that an indicating pointer or pen on a chart gives a visual indication of the furnace temperature and, in addition, moves the potentiometer in the temperature control instrument to apply the proper a-c voltage to the primary of the feed-in transformer. The feed-in transformer steps up this a-c voltage and impresses it on the grid-cathode circuit of the GE85 tube and thereby controls the "turn-on" voltage.

Locating and Correcting Trouble

Two types of trouble may be present when putting the system in operation:

1. Load voltage remains low.
2. Load voltage remains at maximum, or cannot be controlled smoothly. Methods for checking and correcting these conditions follow:

1. Load voltage remains low

a. Visually inspect the tubes in their sockets to determine if the filaments are energized, which will be evidenced by a red glow at the filament and the glass bulb being hot.

(1) If the filaments are energized proceed to c. below.

(2) If the filaments are not energized proceed to b. below.

b. (1) Check the line voltage at the panel.

(2) Check the voltage on the primary and secondary of the control transformer.

(3) Check the voltage on the primary of the filament transformer.

(4) Measure the voltage at the filament terminals on the tube sockets. If there is rated filament voltage at the tube sockets, the tube filaments should light up providing the tube filaments are not broken and the filament pins on the tube base make adequate connection with the tube socket.

c. Remove the GE85 tube.

(1) If load circuit and anode circuit for FG57 thyatron are intact, load voltage should increase to maximum.

(2) If load voltage does increase to maximum, trouble is in grid-control circuit for GE85 tube. Reinstall tube and proceed to d. below.

(3) If load voltage does not increase, trouble is in connections. Check all connections carefully. Whether or not the anode circuit is intact can be easily checked by removing the FG57 from its socket and replacing it temporarily with an FG32 phanotron. As there is no grid in the FG32, it will pass full current if the anode circuit is intact. If the anode circuit is intact, install a new FG57 thyatron and check operation after the initial 15-minute preheating period always required when installing a new thyatron or phanotron.

d. (1) Reinstall the GE85 tube as stated in c. (2).

(2) Check voltage from points H and L on potentiometer in temperature control instrument; it should be 4 volts.

(3) Check voltage across position adj. (This should be 8 volts.)

(4) Check voltage from points H and C on potentiometer in temperature control instrument; it should vary

from 0 to 4 volts as slider is moved on potentiometer.

(5) Put temperature-setting pointer opposite temperature-indicating pointer in the control instrument. (Instrument potentiometer slider should be approximately in middle of potentiometer). Set band width adj. at 1. Check voltage across primary of feed-in trans. (across Cap. D); it should be about 6 volts with position adj. at 0 and decrease to approximately zero, then rise to about 2 volts as position adj. is turned from 0 to 10.

(6) Connect the vacuum tube voltmeter or multimeter across the secondary of feed in trans. and check the a-c voltage while repeating d. (5). Voltage should have same general shape as in d. (5).

(7) Measure Res B. It should be about 0.1 megohm.

(8) Measure d-c voltage across Cap. A with VT voltmeter and repeat d. (5). Voltage should increase from about 10 to 90 volts.

2. Load voltage remains at maximum or cannot be controlled smoothly.

a. Check the polarity of anode and control voltages with cathode-ray oscilloscope. These voltages should have the polarities indicated by the "X" marks on anode and control trans on diagram.

b. Install a new FG57 thyatron. The 15-minute preheating period for new thyatrons and phanotrons should be observed.

c. Install a new GE85 tube.

d. Turn min. adj. to 100 and max. adj. to 0.

(1) Check voltage across secondary winding of feed-back trans. This should be at least 70 volts a-c.

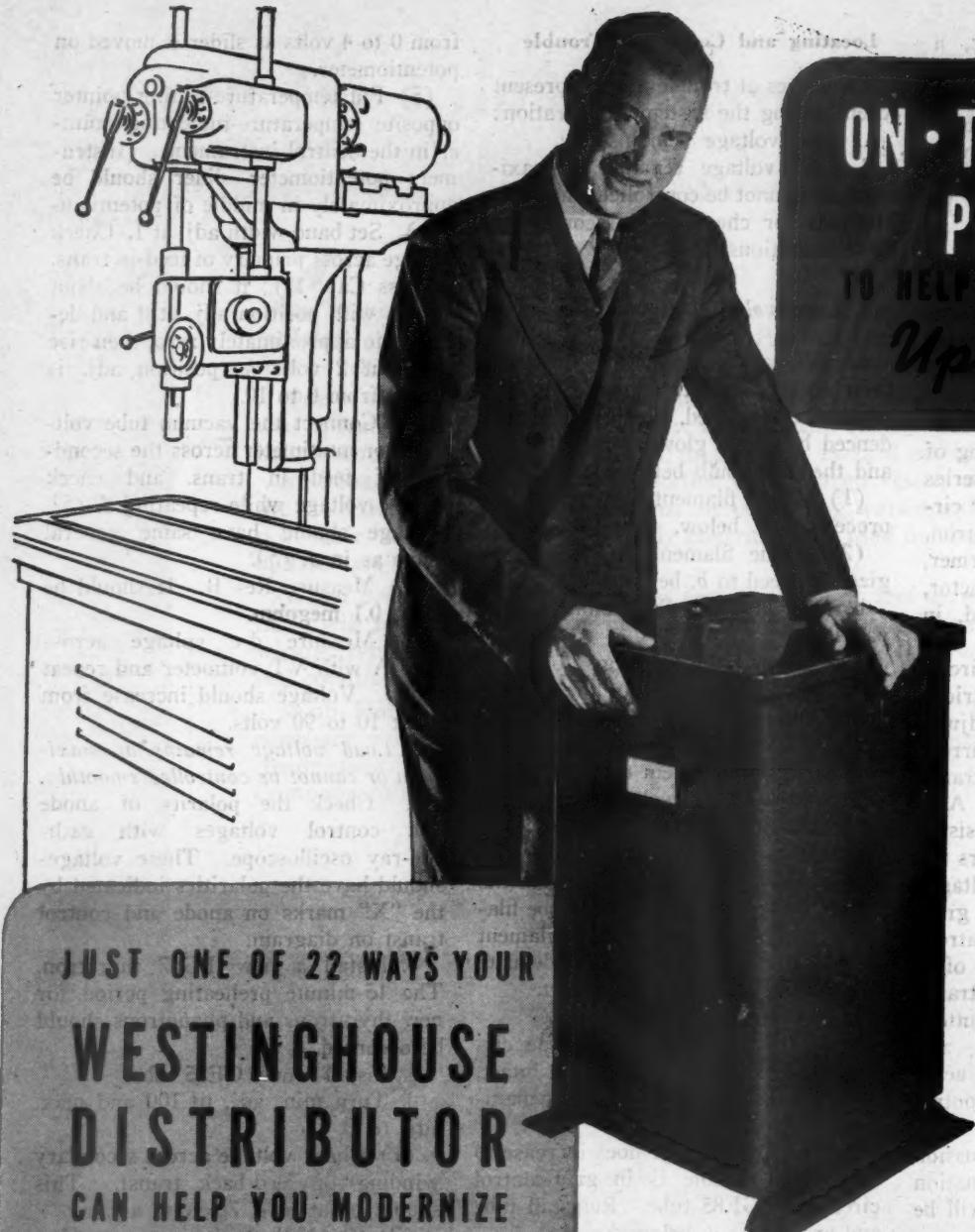
(2) Check the voltage across Cap. B. This should be at least 100 volts, using a vacuum tube voltmeter.

(3) Check the polarity of anode voltage and voltage across the secondary of feed-back trans. with cathode ray oscilloscope. These voltages should have the polarities indicated by the "X" marks on anode and control trans. on diagram.

(4) Turn position adj. to 0. Check the voltage across Cap. A. This should be about 10 to 15 volts d-c. Then check the voltage between grid and cathode of FG57. This should be about 85 volts d-c (the grid should be negative with respect to the cathode).

e. Replace socket for FG57 tube, as connection to grid pin may be defective.

Although the above suggestions apply specifically to the system shown in Fig. 6, the procedure outlined should be of assistance when servicing other types of systems.



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IN THE NEWS

ILLINOIS CHAPTER, IAEI HOLDS MID-YEAR CONFERENCE

Members of the Illinois Chapter, Western Section, International Association of Electrical Inspectors convened at the Hotel Leland, Aurora, Illinois on June 7-8 for their fifteenth mid-year meeting. Chairman Leonard E. Ewald presided over the full two-day program of four educational sessions planned around the theme of electrical industry problems that directly affect the electrical inspector.

The initial talk on inspector-contractor relations was presented by George W. Reinke, Chicago electrical contractor. Mr. Reinke urged closer cooperation between the inspector and contractor particularly in reporting criticized wiring installations. Such criticism should be directed to the contractor rather than the owner, Mr. Reinke believes. When inspectors suggest to factory owners the employment of electrical maintenance men, Mr. Reinke asked that they cooperate by recommending legitimate electrical contractors to handle such repair and maintenance work. Contractors have the equipment, skilled mechanics, know-how and Code knowledge to efficiently and economically do such work, he concluded.

An insight into the tremendous post-war market for homes and electrical

appliances was presented by C. W. Tennant, general sales manager, Western United Gas and Electric Company. Discussing the prefabricated homes field, he reviewed the plans of the Kaiser Community Homes Corporation to build two-bedroom homes for \$4,000 to \$5,000 including complete kitchen equipment and air conditioners; also the decision of the Precision-Built Homes Corp. of Trenton, N. J. to sell reasonably priced "packaged homes" in leading department stores throughout the country.

Citing an Office of Civilian Requirements survey made on 4,500 families in 68 communities of 45 states and the District of Columbia, representing a cross-section of the nation's population, Mr. Tennant revealed a current demand (as of last month) for 5,852,000 refrigerators; 3,451,000 sewing machines; 4,451,000 vacuum cleaners; 5,085,000 radios; 5,195,000 electric irons; and 5,835,000 washing machines. With such a pent-up demand for modern electrical appliances and modern lighting in America's homes, its high time for the electrical industry to do something about adequate home wiring, Mr. Tennant commented, adding that more than 95 percent of America's homes have wiring that is adequate to carry efficiently the *present* lighting and appliance loads. All surveys, he continued, indicate that by the end of the fifth year

after the war the national average residential annual consumption of electricity may reach or exceed 2000 kilowatt hours (1944 national average consumption was 1151 kw.-hrs.).

Concluding, Mr. Tennant pointed to the need for the electrical industry to raise its sights and establish a clearly defined functional standard for residential wiring, since the National Electrical Code—a *minimum* safety standard—is far too often interpreted and used as a standard of function.

Relating "What's New in the Electrical Industry", A. J. McGivern, managing director, Chicago Electrical Wholesalers Association, reviewed the action of the War Production Board in relaxing and revoking a number of limitation orders since V-E Day. He advised that on July 1, wholesalers were permitted to place larger stock orders for wire in anticipation of an increased demand when unrated orders can be shipped—provided all rated orders have been filled. Order L-41 has been amended to permit several times as much modernization and repair work as previously allowed, he added, cautioning, however, that despite these relaxations production of goods for civilian needs will be limited for some time due to existing high military requirements.

The many conditions that dictate the types of synthetic rubber production—



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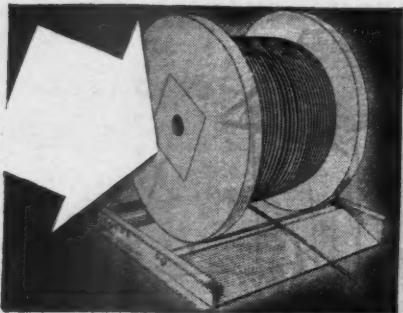


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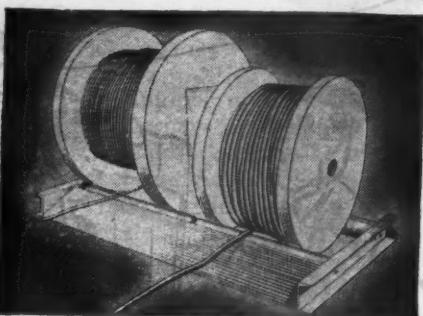
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such as application, electrical and mechanical properties, cost, etc.—were outlined by Howard H. Weber, sales manager, Wire and Cable Dept., United States Rubber Company. He justified the production of numerous types of synthetic rubber by pointing out that some synthetics possess characteristics that are desirable, while others do not—hence the development of different types for specific service conditions.

Basically, synthetic materials are grouped into two classes: Thermosetting materials—those requiring vulcanization like natural rubber; and thermoplastic materials which do not require vulcanization, Mr. Weber revealed, adding that Buna-S—the main substitute for natural rubber—is now extensively used for insulating wires and cables. Buna-N, Neoprene, Butyl and Thiokols are other thermosetting synthetics.

In answer to numerous questions on various types of synthetic insulations, Mr. Weber explained the various characteristics and general uses of each. In general, conditions taken into consideration in the development of synthetic insulations are moisture-resistance; aging characteristics; resistance to attack by oils, acids and alkalies; exposure to sunlight; and combustibility, he explained, stating that the study and research of synthetics for insulating purposes is continuing most vigorously.

The inspectors were treated to an interesting and educational slide-film demonstration of the many applications of electronic equipment in industry, presented by Tracey E. Johnitz, application engineer, General Electric Co., Chicago. Many of those present decided then and there that a greater familiarization of such equipment would stand them in good stead in the future.

The first day's session concluded with a historical review of the development and improvement of armored cable—the first self-contained assembly provided for general wiring purposes. The author of this interesting and comprehensive paper was H. M. Dreher, electrical engineer, Armored Conductor and Flexible Metallic Conduit Section, NEMA, New York.

What one architect thinks of adequate wiring was vividly conveyed to the inspector group at the opening of the second day's session. J. E. Coyle, Chicago architect, told the inspectors that he considers adequate wiring a "must item" in home construction since it provides the key to modern living. In general, architects will specify such wiring but they need the help of the electrical industry to make it "stick".

Mr. Coyle took issue with electrical contractors for their apparent lack to do much to enhance their own interests in the residential wiring field. While others are selling the prospective owner and architect on roofs, doors, windows, floors, plumbing and heating, painting and sheathing, appliances, etc., the electrical contractor fails most completely to work for and follow up his interest, he contended. It is not enough to let the efforts of the appliance salesman bring a demand for adequate wiring to accommodate his wares. It is up to the

electrical associations and contractors to sell the prospective owners so they will begin to demand and be willing to pay for the added convenience that adequate wiring affords, he concluded.

The concluding feature of the conference was a discussion of the Electrical Committee program and recent reports of the Article Committee of the Electrical Committee for revision of the National Electrical Code presented by Alvah Small, president, Underwriter's Laboratories, Inc., and chairman of the Electrical Committee, NFPA. Mr. Small's remarks were confined to such important Article Committee report items as he considered of most interest to inspectors. The complete Article Committee Report was published by the IAEI in March 1945 and is in the hands of all members.

NORTH DAKOTA CONTRACTORS MEET AT FARGO

The North Dakota Electrical Contractors Association membership of slightly less than 50 (representing a majority of active contractors in the state) permitted them to hold a conference (under ODT rules) at Fargo on June 25th. Some 45 members convened to discuss such vital problems as the establishment of statewide electrical inspection, field service by the State Board of Electricians, a public relations program and a more comprehensive association program.

If the recommendations of the group are carried out, the inspection and field programs will be put into effect soon. As for the public relations and association programs, the consensus of the group was that this could best be worked out if the North Dakota Group affiliated with the Minnesota Electrical Council while still retaining its full membership and identity. Upon the invitation of the North Dakota group, William A. Ritt, secretary-manager of the Minnesota Electrical Council presented the Council program and discussed various phases of group affiliation. The Minnesota Council already has ten members in North Dakota with many more expressing a desire to obtain the Council services.

The North Dakota Electrical Contractors Board of Directors went on record endorsing the program of the Minnesota Electrical Council and will suggest to all of its members who may be interested that they join the Council as individuals. If 50 percent of the members join the Council (a situation that is likely to materialize within six months), the North Dakota Group will make a proposal to the Council for affiliation of the entire group as one of the sponsors of the Minnesota Electrical Council. At present a most wholesome and cordial feeling exists between two electrical organizations.

Officers elected to guide the activities of the North Dakota Electrical Contractors Association during the coming year are: President—Clyde Kiely, Grafton; vice president—Carl Wild, Milton; secretary-



INSULATED BUSHINGS

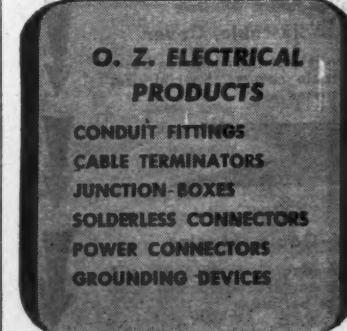
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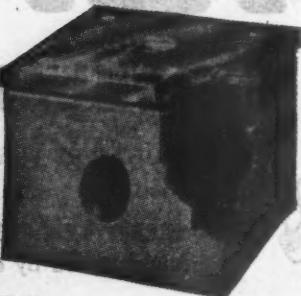


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"Bull Dog"
BX Cable Staples

These dependable staples are still
available in any desired quantity. Car-
tons, kegs or barrels.

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

treasurer—George Hilstad, Dickinson. Elected to the Board of Directors were B. K. Skeels, Bismarck; Fred J. Miller, Dickinson; Harold Nisbet, Grand Forks; Dewey Rasche, Bottineau; and Ed Laskowski, Linto.

NISA HOLDS REGIONAL MEETINGS

Following the policy adopted at the April meeting of the NISA Board of Directors at Chicago, numerous Regional Meetings are being held throughout the country in lieu of a national convention which was cancelled because of wartime travel restrictions. At these meetings the same subjects pertinent to successful shop organization and operation are discussed as were covered at the Director's meeting.

At Region 7 meeting held in Cincinnati, members from all three states (Ohio, W. Va., and Ky.) were present with a number of guests including President Braunlich of Pittsburgh, S. U. Steffner of Chattanooga and seven members from Indiana. Discussing problems of re-employing returning veterans, a Mr. Shanks of the U.S.E.S. urged that each firm formulate a plan now so that there will be no delay in putting the plan into action when the veteran returns. Frank Willey reviewed the developments in the Job Classification Plans and discussed the Sales Survey Report, M.P.R. 581, new ideas and Rewind data. One significant conclusion reached at the session was that a perfect stripping method for all operating conditions has yet to be found.

At Birmingham, Ala., the Tennessee Chapter and members of Region 6 met in an all-day session. S. U. Steffner, Director from the 6th Region presided and the program committee was headed by M. M. Argo. Frank Willey of Cincinnati again reviewed the progress made with the Job Classification and Merit Rating Plans while Selden High, also of Cincinnati, discussed the Sales Survey Report which he had compiled from membership surveys. The simplified bookkeeping system was also studied and resulted in several members stating their intentions of instituting the system in their own shops. Following an interesting inspection trip to the American Cast Iron Pipe Company, the session ended with a review of the Surplus War Property problem, lead by President Braunlich of Pittsburgh.

NISA CHAPTERS ELECT OFFICERS

Two eastern Chapters of the National Industrial Service Association recently elected officers for the current year. The chapters are located in Regions 1 and 2. Results of the elections follow:

New England Chapter (Region 1):
President—Fred S. Ferris, Northeastern Electric Co., Boston, Mass.; vice president—J. J. Reddington, J. J. Reddington

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Electric Service Co., Boston, Mass.; secretary-treasurer—Alfred Elson, Jr., New England Machine and Electric Co., Pawtucket, R. I.

New York Metropolitan Chapter (Region 2): President—Hillrie Q. Griffith, L. S. Belyea Co., Jersey City, N. J.; first vice president—Robert E. Patten, Patten-Brown Co., New York, N. Y.; treasurer—Harry G. Willis, Willis Motor and Armature Co., Jersey, N. J.; executive-secretary—Louis D. Kennedy, 303 Lexington Ave., New York, N. Y. William J. Wheeler, president of The Maintenance Company, New York, N. Y., is chairman of the Executive Committee.

A PROGRAM FOR TRAINING ELECTRICIANS

A joint industry-labor-government program for the training of electricians through apprenticeship has been established on a nationwide basis, according to the Apprentice-Training Service of the War Manpower Commission.

Standards were agreed upon by the National Joint Apprenticeship Committee for the Electrical Industry, whose members are representatives of the National Electrical Contractors' Association and the International Brotherhood of Electrical Workers. The Apprentice-Training Service assisted in establishing the standards, which were approved by the Federal Committee on Apprenticeship. They are contained in a booklet published by the Apprentice-Training Service. The booklet may be had from ATS, War Manpower Commission, Washington, 25, D. C.

The program provides for on-the-job training with specified wages and related classroom instruction. Provision is made for transfer between employers to provide the broadest possible training and the steadiest possible work. Candidates must be between 18 and 24, but these limits may be waived for veterans.

A. F. WAKEFIELD ELECTED PRESIDENT OF IES

Albert F. Wakefield, president of the F. W. Wakefield Brass Co., Vermilion, Ohio, has been elected president of the Illuminating Engineering Society. He will take office October 1.

Mr. Wakefield has been active in the Society for over 25 years, serving on numerous non-technical committees of IES before his election to vice president in 1943.

He is a former chairman of the Commercial Lighting Equipment Section of the National Electrical Manufacturers Association, and has served on both the Incandescent and Fluorescent Lighting Equipment Advisory Committees of the War Production Board, Washington, D.C., throughout the war. Other national officers elected by the



Ready To Serve You!

No Re-Conversion Necessary

We have been manufacturing the same type of Air-Cooled Transformers for war as those regularly required by contractors and industrials.

This is our principal business, not a side line.

We are pioneers in the development and manufacturing of Air-Cooled Transformers.

A size and type for every purpose.

1/4 to 1000 KVA. All voltages.

SORGEL
AIR-COOLED
TRANSFORMERS

SORGEL ELECTRIC CO., 836 W. National Ave., Milwaukee 4, Wis.

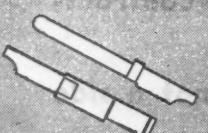
Select
the right
CANNON PLUG
for your job

Cannon manufactures the largest line of electric plugs and receptacles in the industry. Most connector needs can be met by some standard Cannon Connector. Four major factors govern the selection of the right one:



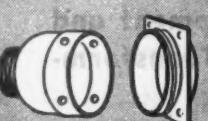
INSERTS

must be large enough to provide required contact diameters and spacing to meet specified voltage and amperage loads.



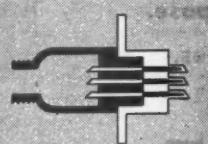
CONTACTS

size, construction and materials are governed by the type of circuit—high frequency, heavy duty, low level or thermocouple.



SHELLS

vary in shape, (round, square, oval or angular) to meet weather, mechanical and safety requirements of the application.



COUPLING METHODS

depend on vibration frequency of use, and the force needed to couple or disconnect, critical in some locations.

Write for this new bulletin "Helps in Selecting an Electric Connector," just printed. Address Dept. A-231, Cannon Electric Development Company, 3209 Humboldt Street, Los Angeles 31, California.

CANNON ELECTRIC

Cannon Electric Development Co.
Los Angeles 31, California

Canadian Factory and Engineering Office:
Cannon Electric Co., Ltd., Toronto, Canada



REPRESENTATIVES IN PRINCIPAL CITIES—CONSULT YOUR LOCAL TELEPHONE BOOK

Illuminating Engineering Society included L. E. Taylor of the Detroit Edison Company as General Secretary; Bruce J. Jensen, Public Service Electric & Gas Co., Newark, N. J. as Treasurer; R. W. Staud, Benjamin Electric Manufacturing Co., Des Plaines, Ill., vice president; and as directors, James M. Ketch, General Electric Co., Nela Park, Cleveland, Ohio and Samuel G. Hibben, Westinghouse Lamp Division, Bloomfield, N. J.

NEW PRIORITIES RATING SYSTEM

Details of a revised and simplified priorities system leading to ultimate discontinuance of priorities assistance for "virtually everything except military requirements" as soon as war-supporting and essential civilian production no longer needs general help, were announced last month by J. A. Krug, Chairman of the War Production Board.

Mr. Krug announced a six month transition period from July 1 to December 31, 1945 to "give business an opportunity to adjust its operations to the new system," which will go into effect after January 1, 1946.

Mr. Krug said transition to the revised and simplified priorities system was necessary because "the military services have substantially reduced their supply programs as a result of victory in Europe."

The new priorities system will be introduced gradually during the period from July 1 through December 31, 1945, which will be known as the "transition period." This period is designed to cushion the impact of the transition from a system under which nearly all production has been regulated to a new system under which military requirements will have top priority but civilian business will generally operate both without production restrictions and without affirmative priorities assistance.

Meanwhile the procedures outlined in the new "Priorities Regulation No. 29" will be instituted gradually during the latter half of 1945. There will also be changes in other WPB regulations and orders, and the board cautioned that if there should be any inconsistency between PR 29 and any other WPB regulation or order, PR 29 controls "unless the other expressly states the contrary."

Under the new priorities rating system the present AA rating method and the Controlled Materials Plan will be discontinued at the end of 1945 and replaced by a system in which the AAA rating will still be assigned in emergencies as under existing procedures but a new MM rating will be assigned by military agencies. WPB itself will assign the MM rating only in cases where it is clearly necessary for the war effort or for requirements of similar urgency.

During the transition period from July 1 to December 31, the MM rating will be equivalent to AA-1. The AA ratings also will be retained for certain materials.

such as textiles, if it is not practicable to adapt existing controls to the new system.

Beginning October 1, 1945, no more AA ratings will be assigned by WPB or other agencies except for deliveries to be made before January 1, 1946. Prior to October 1, 1945, WPB will cancel outstanding AA ratings calling for delivery after the end of 1945, whenever this can be done without interfering with war production or war-supporting activities. Further details on this phase of the transition will be announced later.

Beginning as soon as possible after July 1, 1945, the military services will assign the MM rating to orders and contracts placed during the transition period for deliveries during or after the transition period. They also may change existing orders with AA ratings to MM ratings if necessary to assure delivery on schedule.

WPB will, if necessary, provide additional procedures to give priorities assistance for war-supporting or highly essential civilian purposes. This may be in the form of a new rating junior to the MM rating or in the form of some other procedure. This will not be announced until more information is available as to the supply of materials for non-military use.

At the end of the transition period, December 31, 1945, the Controlled Materials Plan and all its regulations will expire automatically, except that part of it which restricts inventories. However, the delivery of controlled materials during the third and fourth quarters of 1945 will continue to be regulated by the plan alone and not by ratings.

Regular applications for allotments will be usually required for the fourth quarter of 1945 for production materials for Class B and unclassified products. Regulations for maintenance, repair, and operating supplies will remain in effect through December 31, 1945, and after that date ratings will generally not be given on a blanket basis.

Military agencies will assign MM ratings for certain construction facilities and equipment, but during the transition period other construction materials will be delivered as provided for in Limitation Order 41.

WPB APPROVING APPLICATIONS FOR RECONVERSION

Adhering to its policy of granting preferential ratings for construction and equipment materials necessary for industrial reconversion, the War Production Board announced it had approved 159 new applications totaling \$44,157,000 from June 30 through July 6, under Priorities Regulation 24 and Direction 5 to Conservation Order L-41.

This made a grand total of 1,279 applications amounting to \$243,681,000 approved from April 1 through July 6, 1945. The previous summary, covering the period from April 1 through June 29, listed 1,120 applications totaling \$199,524,000.

THE REFLECTOR IS THE BACKBONE OF ANY LIGHTING SYSTEM . . .



Scraping Dept. Gould & Eberhardt, Inc., Irvington, N.J.

"Day Shift" production around the clock!

When you give workers *Skilled Lighting* . . . the product of Wheeler's advanced engineering . . . you improve morale, bring daylight speed and accuracy to the job 24 hours a day!

That's one big reason why it's important to install Wheeler Reflectors — product of 64 years of specialized light engineering. Wheeler Units are engineered to provide maximum light from standard lamps. Their high reflection factor puts light to work where it belongs — on the job. Made of heavy gauge metal, coated with vitreous enamel, their rugged construction insures long service, easy maintenance.

Learn how these better-engineered units can bring *Skilled Lighting* to your production scheme. Send for catalogs showing complete line of incandescent and fluorescent fixtures. **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass. Also New York. Representatives in principal cities.**



All-Steel Open-End
Fluorescent Unit

Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channel with accessible, enclosed ballast. Can be mounted from chain or conduit, individually or in continuous runs.

RLM Solid Neck Incandescent Reflector

Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

Distributed Exclusively Through Electrical Wholesalers

wheeler *Skilled Lighting* **REFLECTORS**

Made by Specialists in Lighting Equipment Since 1881

Time SAVED
is Money MADE

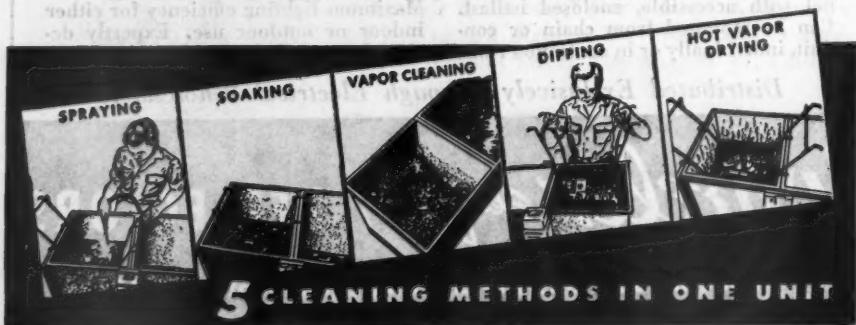


Circo Chief DEGREASER

When parts cleaning hours are whittled down to minutes, when the time wasted by a mechanic in cleaning parts is eliminated, when cleaning materials are salvaged, not thrown away—that's time saved and money made in parts cleaning. All of this adds up to the performance of the new, modern, remarkably fast "Circo Chief" twin tank degreaser—a "3 minute record" cleaner of dirty greasy parts, equalled by no other cleaning unit. It is by far the greatest advancement made in parts cleaning in twenty-five years. "Circo Chief" cleans parts five different ways; hot solvent vapor cleaning (automatic), drying (automatic), spraying (automatic), dipping and soaking. Method best suited for the job depends upon the condition of parts. Anyone can operate the "Circo Chief"—it starts and stops automatically, heats automatically, and feeds itself solvent automatically. All the operator does is vapor clean is feed it parts—the unit does all the cleaning. Solvent is non-flammable and all types of metal parts can be cleaned at the same time without any harmful effects.

This you can depend upon—the "Circo Chief" will clean and dry metal parts faster, more economically, more thoroughly with less effort, less of mechanic's time, at less cost than any other unit or method on the market. It will show bigger profit on each and every job. See it in action and you'll sell yourself—it's a revelation.

CIRCO PRODUCTS COMPANY



At the close of business July 6, iron and steel products had had a total of 306 applications approved to the total value of \$48,903,000, of which amount \$21,205,000 was for construction and \$27,698,000 for equipment. Automobiles and equipment had 271 approved applications amounting to \$141,227,000, of which amount \$46,486,000 was for construction and \$94,741,000 for equipment.

Machinery other than electrical ranked third with 264 applications approved at a total value of \$27,419,000, of which amount \$8,358,000 was for construction and \$19,061,000 for equipment.

CRITICAL MATERIALS AND PRODUCTS

A revised list of critical materials and products was submitted to the War Production Board last month by the Joint Committee on Critical Materials and Products.

Critical materials and products are defined as those which are now, or expected to be, in short supply and which threaten to limit the production of essential products or the fulfillment of programs of high urgency.

Included in the revised list are—
Belting, Conveyor
Cadmium
Capacitors, Electrolytic, Dry Tape
Capacitors, Fixed Paper Dielectric,
Wax Impregnated
Motors, Fractional hp. Electric
Pipe Fittings and Unions, Malleable
Iron
Resistors, Fixed Composition, Ins-

Resistors, Fixed Composition, Insulated 0.25 Watt

**Resistors, Fixed Wire Wound Molded
Sheet and Strip, Steel, Carbon & Alloy
Strapping, Steel**

Switchgear, Metal Clad, Including Circuit breakers

Tape, D. R., Waterproof Rubber Insulated (Signal Corps Specification STL-192)

Transformers, Power and Distribution
Tuhesm Electron, Sub-Miniature and
Microwave

Microwave

**GENERAL PROGRAM
ORDER No. 517**

A clarification of War Production Board policy with respect to newcomers to business and industry, including veterans, was issued recently by WPB as General Program Order No. 517, the agency reported, as a step toward assuring that newcomers will receive a fair share of production materials and production quotas.

The order provides for the establishment or increase of exemptions, for new small users, from restrictions of limitation and materials conservation (L and M) orders, WPB said.

Hereafter, the board announced, applications for production materials or for production quotas will not generally be

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denied on the ground that the applicants were not previously engaged in that production. The order provides an exception to this in the case of certain materials if there are special circumstances that make it impracticable or highly undesirable because of the war economy to follow this policy. At the same time, steps will be taken to establish reserves of certain materials to insure their availability for newcomers.

Limitation and materials conservation orders will be loosened for the benefit of small users (including newcomers) as additional quantities of materials become available in the event the additional quantities are not sufficient to warrant complete elimination of controls, WPB said.

REA ADVISES COOPERATIVES NOT TO MERCHANDISE

Cooperatives operating rural electric systems financed by REA loans have been advised by the Rural Electrification Administration that they should not undertake merchandising of electric equipment unless necessary. REA has released a policy statement which recommends that the REA cooperatives collaborate with commercial dealers on an impartial basis.

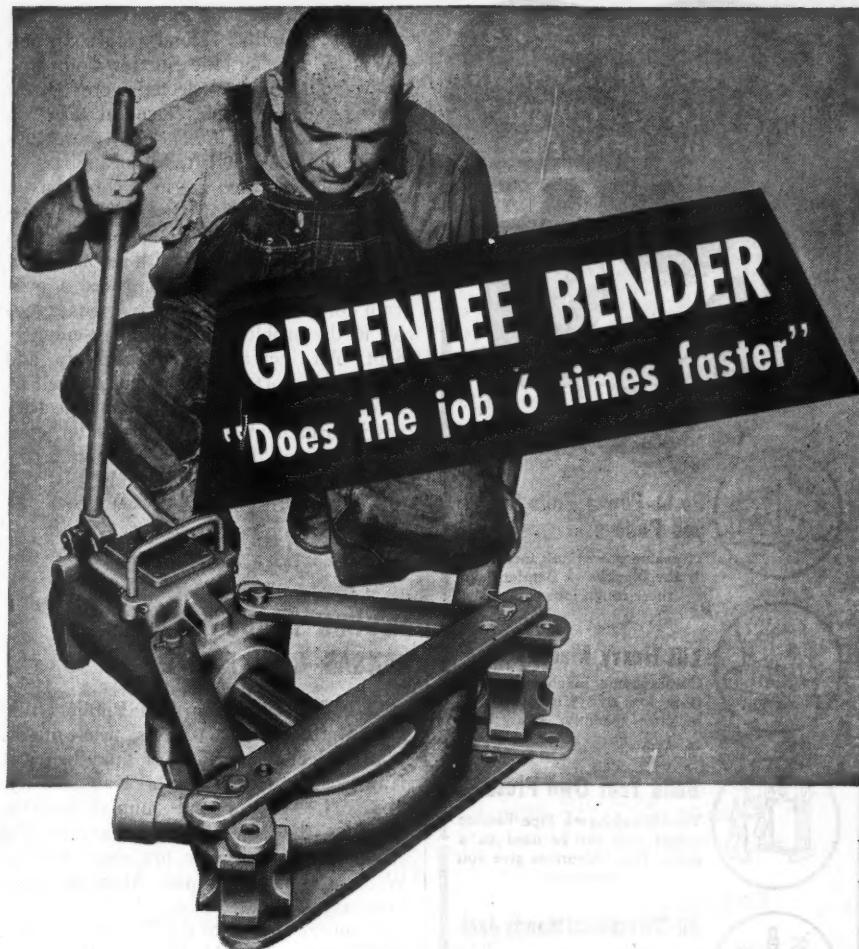
Ways in which the REA cooperatives can help dealers to serve better the rural market are listed in the REA report, "Helping Farmers To Get Equipment."

Some of the suggestions are:

"Collaboration by a distributing cooperative should be impartial; with all dependable dealers and not with a selected few. It can be expressed in many ways; by conferences at which is fully explained the potential market represented by members, how wide a range of equipment will be in demand, the varying degrees of saturation of the various items—even the names of members for circularizing purposes if given to all dealers alike. Space in the Cooperatives' offices can be offered for display of dealers' samples. It is especially necessary that dealers be stimulated to make adequate provision for servicing, and the dependability of each in this respect should be a matter of observation and stimulation. The attention of dealers should be called to the possibility of financing members' purchases on an installment sales basis through Section 5 loans of REA by special arrangements through the electric distribution cooperative."

YOUNG AGAIN HEADS N. C. E. I.

H. E. Young, vice president, Northern States Power Co., Minneapolis, Minn., was re-elected chairman of the North Central Electrical Industries at a June 28th meeting of the Board of Directors. Other officers chosen at that time include: First vice chairman—R. F. Pulver, vice



"Conduit bending jobs taking three hours with old methods now are done in about 30 minutes with a GREENLEE Bender," says W. W. Huntress of Commonwealth Electrical Company, St. Paul.

"The GREENLEE operates easily," he also reports, "and is so portable that it can be used right on the job, in even the most unheard of places, and on a great variety of pipes."

This experience typifies that of the thousands who own GREENLEE Benders. You, too, can save greatly by using

a GREENLEE . . . for one-man, precise bending of pipe up to 4½", rigid and thin-wall conduit, tubing, bus-bars.

Remember—whatever your bending job—there's a GREENLEE to do it faster, smoother, better! For facts on GREENLEE Hydraulic and Hand Benders and other tools to speed electrical work, write today for free Catalog 33E. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1748 Columbia Avenue, Rockford, Illinois, U.S.A.

Special Notice: GREENLEE Electricians' Bits now available in 10, 11, 12-sixteenths sizes.



KNOCK-OUT TOOLS Eliminate time spent on drilling and filing to enlarge holes. In 1½ minutes or less you can cut a hole up to 3½" with a GREENLEE Cutter or Punch. Just insert tool in a knock-out or small drilled hole, give a few turns of the drive nut with an ordinary wrench! For clean, round holes in bakelite, hard rubber or any metal up to ½" thick.

OTHER GREENLEE TIME-SAVING TOOLS FOR ELECTRICAL WORK
Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

CHECK THESE *Extra* USES for BLACKHAWK PORTO-POWER PIPE BENDERS

Porto-Power Pulls Shafts and Pulleys
The same power unit furnished in the Blackhawk Bender licks these tough jobs easily.

Lift Heavy Machines
Cumbersome machines raised from low of $3\frac{1}{2}$ in. to $8\frac{1}{2}$ in. height — speedily, safely with Porto-Power.

Build Your Own Press
Your Blackhawk Pipe Bender power unit can be used in a press. Free blueprints give you directions.

All-Directional Handy Jack
Porto-Power rams operate at any angle to do 1,001 tough jobs easily, safely and fast! Operator is always safely away from danger zone.

GET all the usefulness out of your Blackhawk Porto-Power Pipe Bender! Sure, it bends pipe up to 4 in. Also, it can be removed from the bending frame to serve as a powerful jack—or with standard attachments to pull, push, spread, press, lift and lower—easily, accurately, safely and fast!

Porto-Power is fast becoming indispensable hydraulic service equipment in maintenance and electrical work, production plants, shipyards, construction companies and repair service organizations.

If you have a Blackhawk Pipe Bender be sure you know all its uses. If you'd like to have one, call your industrial supply distributor or write Blackhawk for complete information on Porto-Power in 7, 10, 20 and 50-ton capacities.

BLACKHAWK

BLACKHAWK MFG. COMPANY
Dept. P2085 Milwaukee 1, Wisconsin
Rush new Hydraulic Equipment
Bulletin V-43 to us.

Name.....

Company.....

City..... State.....

president, Minnesota Power and Light Company, Duluth; second vice chairman —Wm. G. Stuefer, the Stuefer Company, Minneapolis. Also re-elected were: treasurer—L. G. Mample, General Electric Supply Co., St. Paul; and secretary-manager, Wm. A. Ritt, Minneapolis.

The Board voted to incorporate as a non-profit corporation; authorized an increase in personnel to assist various branches of the industry with reconversion and postwar plans; and approved a program for cooperating with various agencies in the problem of veteran re-employment. An increase in membership and industry support was reported, as well as national and local recognition of the successful organization effort to better conditions for all branches of the industry and its relations with the public.

McGURN HEADS KANSAS CITY E. M. E.

T. F. McGurn, Board of Public Utilities, Kansas City, Kansas, was unanimously elected president of the Electrical Maintenance Engineers of Kansas City, Missouri, at a recent annual meeting marking the second anniversary of the group. Chosen as vice president was L. W. Coate of the Butler Manufacturing Company.

Members elected to the Executive Committee were: John H. Masters, War Battery Plant (who succeeds himself); E. F. Tovrea, Sewall Paint & Varnish Co.; Fred G. Ehlers, Research Hospital; and Leonard McClanahan, North American.

..“In recognition
of outstanding
achievement”

When—

The present recognized leader in the manufacturing of electrical products for our Merchant Marine turns to production for peace.

This Trademark—

Will continue to be known as the symbol of quality and service.

Zinsco

ELECTRICAL
PRODUCTS

MANUFACTURED BY ZINSMEYER CO.
LOS ANGELES

about \$665,000,000 at 1940 prices," Mr. Foreman declared.

"Schools and other public buildings would require about \$645,000,000 worth of materials, broken down as follows:

"Electrical wiring and fixtures, \$39,000,000; forest products \$96,000,000; iron and steel products, \$247,000,000; paints and varnishes, \$7,000,000; roofing, insulation and waterproofing materials, \$17,000,000; sheet metal, \$5,000,000; stone, clay and glass products, \$192,000,000; other materials, \$41,000,000.

"For the water and sewerage system and other facilities about \$615,000,000 worth of materials would be required.

"If a half million houses are constructed in the first postwar year," he stated, "this program would require from \$1,000,000,000 to \$2,000,000,000 in materials, figured even at the low average cost of \$5,000 including land cost."

MINNEAPOLIS CONTRACTOR AWARDED ARMY-NAVY "E"

The Electric Repair and Construction Company, Minneapolis, Minn., was awarded the Army-Navy "E" Pennant for excellence in war production at an impressive ceremony at Port Cargill, Savage, Minn., June 23rd.

Following posting of the colors by a U. S. Naval Air Station color guard, Chaplain R. S. Toulman gave the invocation. Acting as master of ceremonies, William A. Ritt, secretary-manager of the Minnesota Electrical Council, gave the address of welcome. Presentation of the "E" Award was made by Commander J. A. Hartman, U.S.N.R., and accepted on behalf of the contractor by A. S. Ingebrigtsen. Lt. Col. J. W. Homewood, U. S. Army presented "E" emblems to employees Harvey D. Young, Harry W. Carpenter and George Hellerstedt. Mr. Ritt concluded the ceremonies with congratulatory remarks.

The Electric Repair and Construction Company is performing electrical work on navy craft in the port. The firm has been in the electrical contracting and appliance merchandising business in Minneapolis for many years. It is the second Minnesota electrical contracting firm to be thus honored. Last year the Arrowhead Electric Company of Duluth received the award for its electrical ship construction work in that city.

RESIDENTIAL BUILDING PROGRAM UNDERWAY

With some 61,500 privately-financed houses now under construction, priorities for 73,000 more are in the hands of builders for future construction, the National Housing Agency has announced.

NHA already has programmed an additional 48,000 privately-financed houses for which priorities now are available. In addition, the agency has the authority

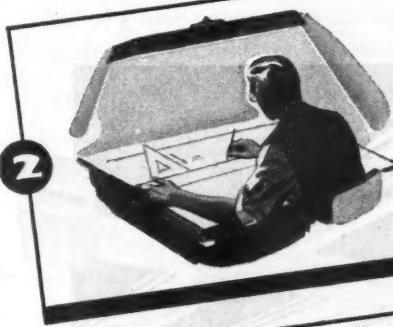
Why these three prefer G-E



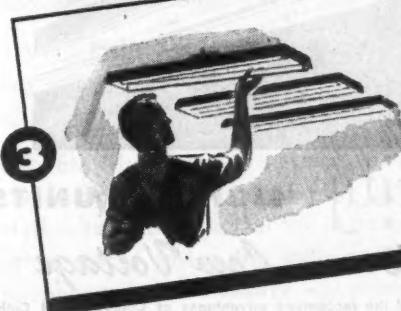
Users of fluorescent lighting, engineers and maintenance men are enjoying more efficient lighting by using G-E Watch Dog Starters. These manual reset starters are providing the utmost in all-around fluorescent lighting service in war factories all over the nation. That's why these three prefer G-D.



Users—are more satisfied with lighting fixtures equipped with G-E Watch Dog Starters because they banish annoying blink and flicker of dying lamps. Blinking cannot possibly recur once the Watch Dog Fluorescent Starters lock out.



Lighting Engineers—specify G-E Watch Dog Fluorescent Starters because of their unusually long life. The Watch Dog outlasts five ordinary starters. This is equivalent to approximately three years of fluorescent lighting service.



Maintenance Men—like G-E Watch Dog Starters because they reduce fluorescent lighting maintenance to the simple job of pressing a red button before relamping. Reset it . . . forget it.

Would you like to know more about G-E Watch Dog Starters? Write for our bulletin, "How to Use Fluorescent Accessories for Best Lighting Results." Send your request to Section G853-8, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

BUY WAR BONDS AND KEEP THEM

GENERAL  **ELECTRIC**

PARTS FOR FANS MOTORS CONTROLS

PROMPT SHIPMENT FROM LARGE STOCKS

AUTHORIZED PARTS DISTRIBUTORS

Brown-Brockmeyer
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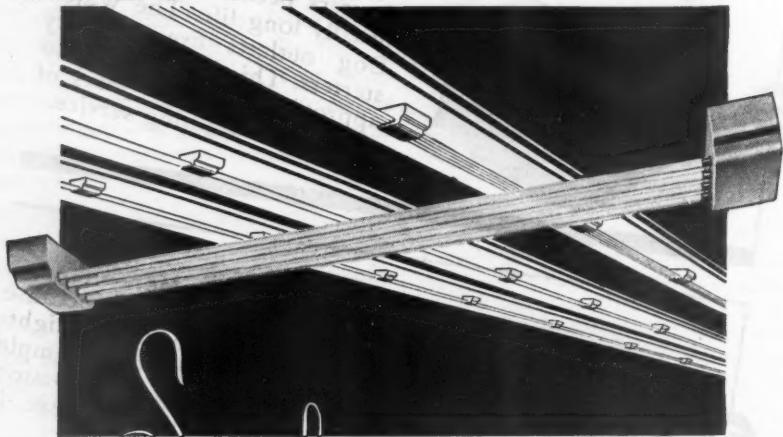
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READING ELECTRIC COMPANY, INC.

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Simplicity
Cold Cathode Low Voltage
LIGHTING UNITS

Long continuous lines of light, possessing all the recognized advantages of Colovolt Cold Cathode Fluorescent illumination, come to you in these "Simplicity" assemblies. Distinctive in design—easy to install—simple to maintain—no gingerbread attachments—no dust collecting areas—"Simplicity" units give balanced illumination with comfortable, easy-to-look-at light for every commercial installation. Units available to make individual 8 foot fixtures or continuous line lighting in multiples of 8 feet. Colovolt 93" 10,000 hour lamps (1) are guaranteed for 1 full year except for failure due to breakage, (2) require no starters—do not flicker, (3) are practically free of intermediate burn outs.

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GENERAL LUMINESCENT CORPORATION

672 So. Federal St.

CHICAGO 5, ILL.

under the current War Production Board Program Determination to issue 98,000 more priorities before January 1. The great bulk of these will be for private construction, according to National Housing Administrator John B. Blandford, Jr.

"This illustrates the size of the residential building program which is getting under way," Mr. Blandford said. "It should be understood, however, that issuance of authority to build doesn't mean that construction will start immediately. Builders have to secure sites, make plans, obtain materials. But the way has been cleared for them as far as possible.

"We hope to see 75,000 houses started in the third quarter—from July 1 to September 30. This compares with 19,000 started in the first quarter and an estimated 55,000 in the second quarter. We are hoping for 400,000 'starts' in the next 12 months although we fully realize the difficulties builders may face even with the availability of programs and priorities.

"As a matter of fact," Mr. Blandford continued, "NHA has moved up on programming to the point where there is little more that we can do in this quarter—the third quarter. The job now is for builders to get under construction the housing already programmed."

NEW CONSTRUCTION SHOWS INCREASE

New construction activity in the United States during June 1945 amounted to \$403,000,000, a four percent increase over May and a 19 percent increase over the \$340,000,000 level of June, 1944, the War Production Board reported.

The volume of new construction for the first half of 1945 was \$2,049,000,000. It is expected that construction activity for the entire year will amount to \$4,400,000,000, or 12 percent more than that for 1944, WPB said. This estimate for 1945 is based on the assumption that war with Japan continues throughout 1945.

Estimates of 1945 construction, broken down into major categories, follow:

Privately-financed construction (industrial, housing and all other types) is expected to exceed publicly-financed work in 1945 for the first time since 1940. Non-industrial military construction is expected to decline in 1945 to 20 percent less than the 1944 volume; and declines of about six per cent from 1944 levels are expected in Government-financed industrial and civilian housing construction. WPB pointed out that these declines will be more than offset by sharp increases in other types of construction, particularly in privately-financed factory building, and in commercial, religious, educational, hospital and miscellaneous structures.

In June, privately-financed construction totaled nearly half of total construction as compared with 40 percent privately-financed construction in June 1944. Privately-financed factory building accounted for \$51,000,000 of total June 1945 construction, or two-and-one-half times more than the volume of construction in

this category in June, 1944. Non-industrial military and Government-financed industrial construction (\$60,000,000 and \$73,000,000 respectively in June, 1945) is expected to decline sharply during the remainder of 1945, as military requirements in the construction field continue to decline.

FHA MORTGAGES INCREASE

Operations of the Federal Housing Administration, of the National Housing Agency, in insuring mortgages on existing houses during the 12-month period ending June 30 were the largest in volume in five years, Earle S. Draper, Deputy FHA Commissioner, has announced.

During the fiscal year 1944-45, FHA received 75,650 applications for mortgage insurance on existing dwellings for a dollar volume of \$378,346,000 and issued commitments to insure in 52,119 cases amounting to \$242,079,000.

"The record for the past year in this activity is really significant in view of present conditions in the real estate market, since FHA in its insurance operations does not recognize temporary inflated prices," Mr. Draper said. "It is evident that more and more people are relying on FHA protection in the purchase of a home."

Mr. Draper pointed out, the ability of FHA to continue insurance of mortgages on existing construction will be a highly important factor in the great building program that is expected after the war ends.

— Book Reviews —

ELECTRICAL POWER USES IN MARINE SERVICE

Volumes I and II of the *Marine Electricians' Library* were reviewed in the June, 1945, issue of *Electrical Contracting*. Volume III of this series is now available, and is titled, "Electrical Power Uses in Marine Service".

This third volume is divided into six sections, the contents including: Alternating-current Motors and Control; Direct-Current Motors and Control; Guide to the Analysis of Complex Control Circuits; Principles of Light Sources; Electrical Propulsion of Ships—Application and Control; and Maintenance of Electrical Equipment—Trouble Detection and Correction.

The discussion covering the electric propulsion of ships is in two divisions. The first treats direct current propulsion for the relatively small power plant, and the second covers alternating current propulsion for the larger size ship.

The section on maintenance discusses general ideas and answers many questions which have been brought up in the past.

The science and engineering inherent in the ordinary incandescent lamp, and principles and operation of new light

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PRODUCTION
SALES

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SYSTEM MS: Selective ringing, common talking system provides complete intercommunication between all telephones on system. One conversation at one time. For offices, schools, banks, hospitals, etc.

TWO-PARTY SYSTEMS: Two-party systems provide ringing and talking service between two telephones. Recommended for residences, offices, stores, schools, theatres. Three wire or two wire.

SYSTEM M: Common talking, common ringing, for any place where communication is required from person to person rather than from station to station. Ideal for factories, large stores, lumber yards and other places where the individuals are not always near their own telephones but can answer any phone when they hear their code call.

Ask for Auth Bulletin 85

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M1 (Synchronous)	1	50 A. at 125 V.	16 Ga. Steel
M2 "	2	50 A. at 125/250	16 Ga. Steel
RM "	1	50 A. at 125 V.	Cast Iron
RMS "	2	50 A. at 125/250 V.	Cast Iron

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sources, such as mercury-vapor and fluorescent, have been discussed in detail, particularly as they relate to shore plant and marine use.

John M. Dodds, instructor at the University of California, and San Francisco field engineer for the General Electric Company, is author of "Electrical Power Uses in Marine Service", Volume III of the Marine Electricians' Library, price \$4.00. The library is published by the McGraw-Hill Book Company, 330 West 42nd Street, New York, 18, New York.

CONTROLLERS FOR ELECTRIC MOTORS

Technical students, operating men, application engineers and purchasers will welcome this manual on all types of commercial electric motor controls. It describes the construction, performance, operation and maintenance of controllers in a simple treatment, readily understandable to anyone having only a limited knowledge of motors. The title of the manual is "Controllers for Electric Motors". Its authors are Henry Duvall James, Consulting Engineer, and Louis Edwin Markle, Design Engineer.

The object of this book is to bring together in one volume sufficient information on controllers to give a good general idea of their design and operation. It covers primarily the types and methods of control in general use, with no attempt to cover all types of special commercial equipment.

Chapters written in elementary style have been included for the benefit of those having little experience with control apparatus.

Among the subjects covered are magnetic contactors, the time-limit method of acceleration, various relay schemes for plugging control, motor-generator control of motor voltage. Regulex, Amplidyne and Rototrol, power factor influence of synchronized motors, full-voltage versus reduced-voltage starting of squirrel cage motors, and recommendations for maintenance of control equipment. Also discussed is the electron tube, which is used as a master switch to control action, as well as a converter to operate a d-c motor from a-c power and to control the motor voltage.

The size of this book is 6 by 9 inches, and contains 324 pages. It is published by McGraw-Hill Book Company, 330 West 42nd Street, New York, 18, New York. Price \$3.50.

ELECTRICAL COILS AND CONDUCTORS

Problems of reactance of cylindrical coils without iron cores, skin effect and eddy-current loss in transformer, generator and motor windings and in busbars, cables and other heavy conductors, are discussed from a theoretical standpoint in the book, "Electrical Coils and Condu-

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ors". Formulas are used throughout the 39 chapters, which have many practical applications, and include most of those needed for practical cases.

Some of the characteristics of apparatus are presented in the form of curves which can be read directly without trouble. The author has relied on formulas and calculations, however, for most of the characteristics, and has assumed that the reader has a knowledge of the principles of operation of the different types of electrical apparatus and a working knowledge of elementary integral calculus.

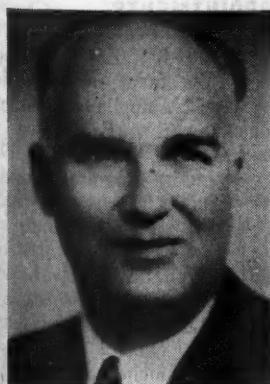
Subjects covered in the various chapters include: operation of delta and V transformer banks, eddy-current loss in transformer windings and armature coils, heat transfer, resistance loss and conductor size, reactance, skin-effect, mutual inductance, force, and standard sizes for rectangular wire. Many of the chapters have been used as class notes on the subject of electrical machinery.

Herbert B. Dwight, Professor of Electrical Machinery, Massachusetts Institute of Technology is the author of Electrical Coils and Conductors. It is published by McGraw-Hill Book Company, 330 West 42nd Street, New York, 18, New York. Price \$5.00.

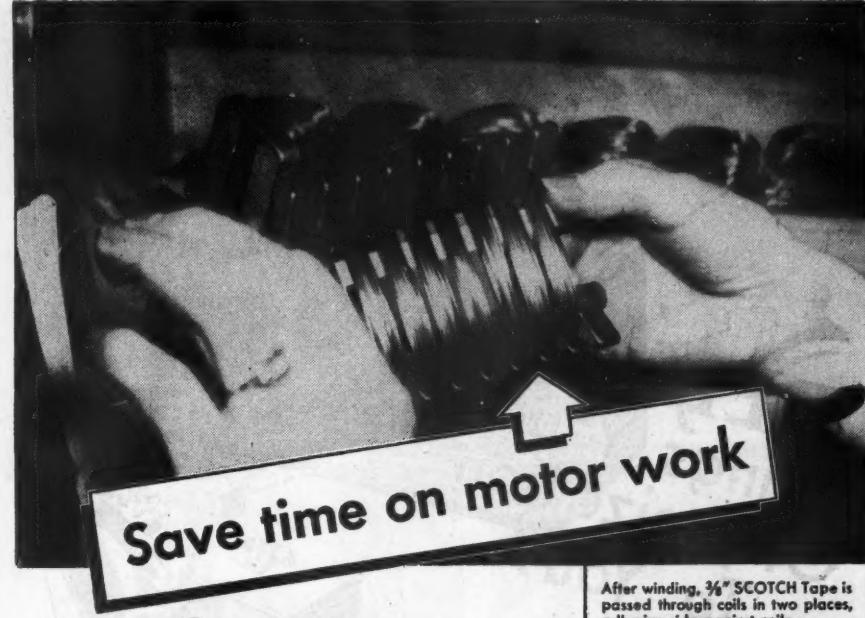
MANUFACTURERS NEWS

CUTLER-HAMMER ELECTS OFFICERS

At the annual meeting of the Board of Directors of Cutler-Hammer, Inc., held on June 15, the management organization was broadened by the election of the following officers—F. R. Bacon, chairman of the Board; H. F. Vogt, chairman of the Executive Committee; G. S. Crane, president; H. F. Vogt, vice president and treasurer; J. C. Wilson, vice president and secretary; P. B. Harwood, vice president in charge of engineering; P. S. Jones, vice president in charge of sales; Philip Ryan, vice president in charge of manufacturing; E. W. Seeger, vice presi-



G. S. CRANE



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Provide time saving and material saving shortcuts in coil and motor work

Motor insulating, coil winding, strapping electrolytic condensers, etc. are speeded up and simplified by time-saving shortcuts made possible by "SCOTCH" Tape. Accompanying pictures, taken in the plant of the Holtzer Cabot Electric Co., Boston, Massachusetts, show how "SCOTCH" Electrical Tape (EB) is used to fasten the coils from the winding machine to the finished job.

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Coils removed from form, after which they are taped with SCOTCH Tape.



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dent in charge of development and assistant secretary; M. R. Fenno, assistant treasurer; and J. C. Springer, assistant secretary.

F. R. Bacon and G. S. Crane were elected as the other members of the Executive Committee.

Mr. Bacon, the founder of the company, has been president from 1896 to the present time excepting for the period between May 1924 and April 1931 when B. L. Worden was president and Mr. Bacon chairman of the board. He now resumes the position of chairman of the board which he formerly held.

H. F. Vogt becomes chairman of the company's Executive Committee and continues as vice president. In addition Mr. Vogt was elected treasurer.

G. S. Crane formerly vice president in charge of sales and engineering becomes president.

WESTINGHOUSE CHANGES

The Westinghouse Electric Corporation has purchased the lamp business of the Ken-Rad Tube and Lamp Corporation, Owensboro, Ky., George H. Bucher, president of Westinghouse, announced recently. Westinghouse has purchased all assets relating to Ken-Rad's lamp business, except cash, accounts receivable and securities. It is the intention to continue the Ken-Rad brand and operate the business substantially the same as it has been in the past, serving Ken-Rad's customers and others. The new unit will be known as the Ken-Rad Lamp Division of the Westinghouse Electric Corporation.

Robert F. Tucker, staff assistant to Ralph C. Stuart, Westinghouse vice president, has been appointed manager of the Ken-Rad Lamp Division. He will be responsible for the Division's entire operation, including manufacturing, engineering and sales.

Harry L. Huntley has been appointed Headquarters Repair sales manager of the 34 plants of the Manufacturing and Repair Department of the Westinghouse Electric Corp. He will have his headquarters in Pittsburgh.

G-E APPOINTMENTS

G. E. Mullin, Jr., has been appointed manager of the farm sales division of General Electric's appliance and merchandise department at Bridgeport, Conn. He joined G-E in 1925. From 1936 to 1939 he was in the company's rural electrification, electrical contractor and educational sections in Schenectady. From 1940 to 1942 he was manager of the farm sales section. When war came he was appointed assistant supervisor of inspection of the appliances divisions, and later was quality control engineer at the Lowell, Mass. launcher plant.

Four new appointments in the Transformer Division of G-E's Central Station

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No, we don't ship ILSCO CONNECTORS in fancy jewel cases. Nor do we make them from castings which are heavy, costly and of poor conductivity when compared to the pure 99.99% electrolytic copper of 100% conductivity used in all ILSCO CONNECTORS.

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Here is another field in which Goodrich has led the way with original and outstanding designs. In service stations all over the country, you'll see many special styles of Goodrich equipment providing efficient illumination to answer specific needs.

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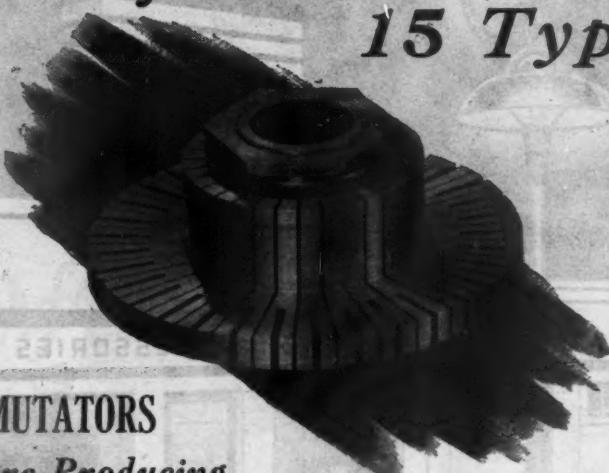
modern, dignified fixture which reduces glare while bringing light nearer the ground for more efficient servicing. The close mounting floodlight is completely adjustable for vertical and lateral positioning to floodlight buildings.

Whether it is for indoor or outdoor lighting, you'll find exactly the fixture you need among the endless variety of sizes and styles in the complete Goodrich line. Write for literature.

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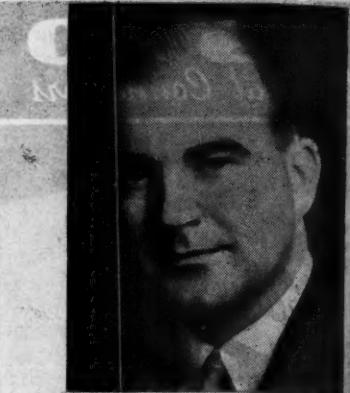
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G. E. MULLIN, JR.

Divisions, have been announced. H. M. Jalonack has been appointed assistant to manager, Transformer Division, and is succeeded as manager sales, Distribution Transformer Section by C. E. Burke of Fort Wayne, Ind., formerly assistant manager sales, Specialty Transformer Section. D. F. Roloff has been named assistant manager sales, succeeding Mr. Burke, and E. V. Dillon, formerly assistant manager sales of regulators, has been appointed manager sales, Feeder Voltage Regulator Section.

Effective June 1, the name of the Customer Division of General Electric's Central Station Divisions was changed to the Electric Utility Division with R. W. Beard appointed manager. The Electric Utility Division will have general overall responsibility for promotion and sale operations with all electric utility customers. The Division has divided the country into three areas by districts, with the following men in charge: E. N. Chilberg, Atlantic, East Central, and South Eastern; R. R. Owne, Central, Southwestern and Rocky Mountain; and A. J. Tacy, New England, New York, Pacific and Northwestern. In addition to these territorial assignments, W. H. Norris, Jr. is responsible for power projects, and W. H. Branch handles contractor business.

To meet the anticipated postwar increase in small motors for electrical appliances and in ballasts for fluorescent lamps, G-E has announced it has selected a site at Tiffin, Ohio and is in process of selecting another site for a new manufacturing plant, both to be operated under the management of the Company's Fort Wayne works.

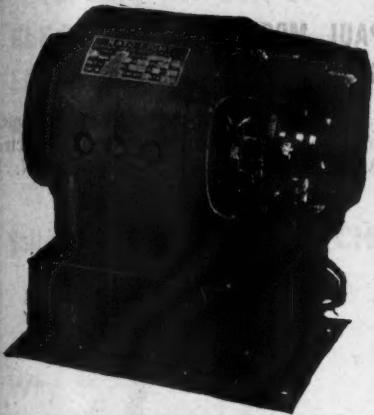
ALL RCA TUBE ACTIVITIES CENTERED IN NEW DIVISION

Organization of the RCA Tube Division to embrace all electron-tube activities of the company, with L. W. Teegarden as general manager, has been announced by Frank M. Folsom, executive vice president of the Radio Corp. of America.

Mr. Teegarden has announced the appointment of key executives within the new division. Dr. G. R. Shaw has been appointed chief engineer; F. H. Troup was named controller; and T. J. Scanlon,

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FOR INDUSTRIAL USE

- Recommended for use where Long Life is essential, where Vibration is excessive, where Inaccessibility of lighting fixtures makes Replacement Difficult, where a Pilot Light is needed.

Available in a wide variety of sizes, shapes, candle power and voltages—standard and candelabra bases.

A large supply of all standard types are carried in stock, thus assuring you prompt service at all times. Write for catalog sheet 1-2 for full details or see your Electrical Wholesaler.

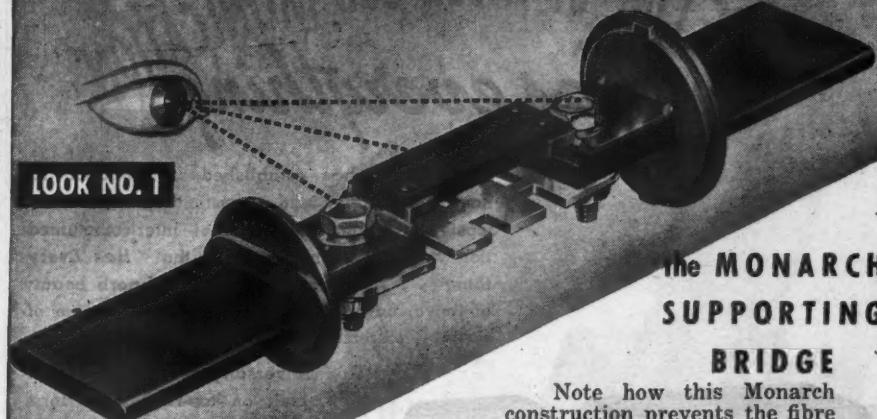


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Take a TWO-WAY LOOK AT THE Monarch Fuse

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SUPPORTING
BRIDGE

Note how this Monarch construction prevents the fibre bar from coming in direct contact with the screw connecting renewal link to knife blade. This minimizes the charring of the fibre bar and positively prevents excessive overheating of knife blades. Note also large metal parts which dissipate heat. Result: dependable protection.

"Look No. 1" illustrates this construction in a lighter-duty Monarch knife-blade fuse and "Look No. 2" shows adaptation of this principle in a heavy-duty model.

LOOK NO. 2

the
FERRULE TYPE



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The Sign of Quality.
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Save dollars on
**MAINTENANCE • REPAIRS • OPERATION
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Easy and simple to install. Simply make wiring connections—screw the hanger to the outlet box—then hang the fixture. No toggle bolts or other fastening arrangements necessary. . . . Self grounding—2-wire cord and plug may be used. Fits on standard 4-in. or 3 1/4-in. outlet box or plaster ring.

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Complete with two 5-ft. chains, cord clips, "S" hooks and receptacle.
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Nationally distributed through leading electrical supply houses



general purchasing agent. H. F. Randolph is manager of the Harrison plant and J. A. King is manager of the Lancaster plant. Sales activities will continue under the direct supervision of Mr. Te-garden.

PAUL MOORE JOINS STAR ELECTRIC

Paul J. Moore has been appointed motor sales manager of Star Electric Motor Company of Bloomfield, N. J.



PAUL MOORE

Mr. Moore has been sales manager of Imperial Electric Co., Akron, since 1944 when he left the General Electric Co., Schenectady, after many years in the Motor Division. He is a graduate electrical engineer, Syracuse University.

MAGUIRE INDUSTRIES ACQUIRES TWO ORGANIZATIONS

Merger of the Thordarson Electric Manufacturing Company of Chicago into Maguire Industries, Inc., as a new transformer manufacturing division of the latter was announced last month by Russell Maguire, president of Maguire Industries.

L. G. Winney, formerly first vice president and treasurer of Thordarson, has been elected a vice president of Maguire Industries, Inc. He will be general manager of the Thordarson Electric Manufacturing Division of the company.

William R. Mahoney, formerly secretary and assistant treasurer of Thordarson, has been elected assistant treasurer of Maguire Industries, Inc. Miss L. A. Strohmayer of the Thordarson staff has been elected assistant secretary of the Maguire organization.

Also the Maguire Industries, has purchased for cash all the stock of the Meissner Manufacturing Company of Mt. Carmel, Ill. Meissner, which is well known in the radio and communications fields, will continue its operations as an independent division of Maguire Industries.

James T. Watson and George V. Rockey, formerly principal stockholders, will continue to head the management of

F. Ran-
son plant
the Lan-
continue
Mr. Tee-

ppointed
Electric
N. J.

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**2208-Watt AUTOMATIC
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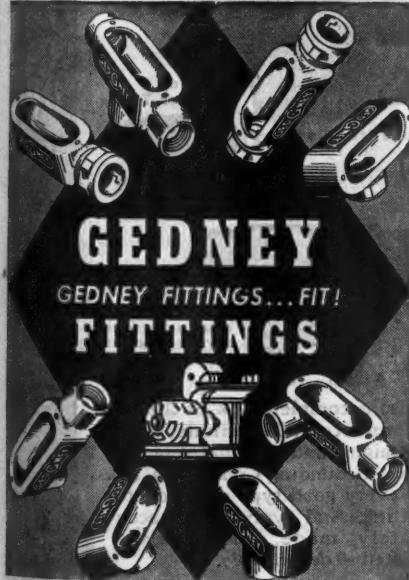
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GEDNEY. Conduit Bodies and Fittings are available for every wiring need. Complete lines of both threaded and threadless fittings are included. All are carefully finished, prettily packed in metal-edge cartons, clearly marked for time saving on the job. GEDNEY fittings are Underwriters Laboratories approved. Write for catalog.



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are all on the INSIDE
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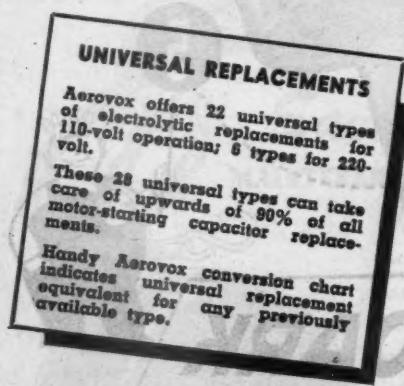
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Meissner and all other key personnel will remain the same. Mr. Watson has been elected vice-president of Maguire Industries Inc., and Mrs. Madge Hubbard an assistant secretary of the Maguire organization.

BENJAMIN ANNOUNCES PLANT IMPROVEMENT AND SALES PROGRAM

"A three-year program of plant modernization, product development and intensive sales promotion" was announced by Walter D. Steele, president of Benjamin Electric Mfg. Co. at the annual stockholders' meeting held in Des Plaines, Ill., June 15.

Chief of these improvements is a new research and testing laboratory on which construction will be started this year. This new addition will have complete facilities for electrical, photometric and acoustical testing. On its roof will be located a weathering tower for testing all types of Benjamin outdoor lighting equipment, floodlights and various porcelain enamel products.

RUSSELL & STOLL APPOINTS REPRESENTATIVES

Appointment of two new representatives, in Birmingham and Boston, has been announced by Russell & Stoll Co., New York. The new southern representative is John E. Anderson, with offices at 1311 Empire Building, Birmingham 3, Ala. He will cover the states of Alabama, Louisiana, Mississippi and Tennessee.

Donald H. Hatch, with headquarters at 20 Providence St., Boston 16, Mass. will be the representative for the states of Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.

CLAROSTAT APPOINTS NEW REPRESENTATIVES

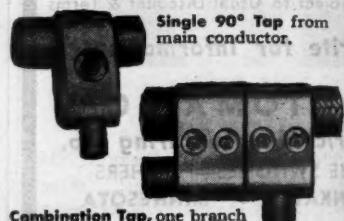
The appointment of two new sales representatives is announced by Clarostat Mfg. Co., Inc. Wood & Anderson Company, 915 Olive St., St. Louis, Mo. will represent the Clarostat line in their territory. Henry P. Segal Company, 143 Newbury St., Boston, Mass. will cover the New England territory.

Graybar Electric Company has named Norman A. Hayes as merchandising manager in Portland, Oregon. During the past twelve years he has been merchandising manager of the Stubbs Electric Company in Portland, and before that he was sales manager for the Northwest Radio Supply Company.

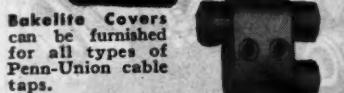


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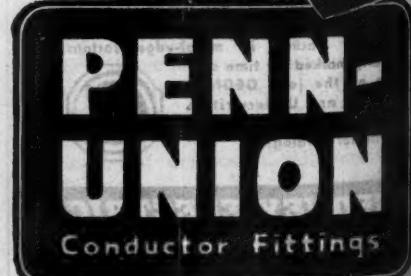


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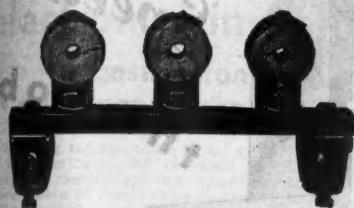
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James M. LaVier, Jr. has joined the staff of Sylvania Electric Company as sales representative serving the Virginia territory with headquarters at Richmond. Early in 1941 he began active duty in the U. S. Army with the rank of Captain and later served overseas before being reverted to inactive duty in May of this year with the rank of Major. Before joining the armed forces he was with the Virginia Electric and Power Company.

Charles A. Butcher has been appointed assistant general manager of the Crocker-Wheeler Division, Joshua Hendy Iron Works, Ampere, N. J. He was formerly manager of the Pacific Coast Manufacturing and Repair Department of the Westinghouse Electric & Manufacturing Company, Oakland, Calif.

The Art Metal Company, Cleveland, Ohio, has appointed George Pellingar as New York sales manager. For twelve years Mr. Pellingar was with the American Reserve Insurance Company, New York, as assistant secretary.

BullDog Electric Products Co. of Detroit announces that Ivan W. Strong has been placed in charge of the Indianapolis territory. He succeeds the late Homer P. Riddell. Mr. Strong was formerly with the Allison Division of the General Motors Corporation at Indianapolis.

Harry L. Fordham has been appointed midwest district manager of the Radiant Lamp Corporation, Newark, N. J. His headquarters will be at the Corporation's new offices at 612 N. Michigan Ave., Chicago. Mr. Fordham was formerly with General Electric Supply Co. as district supervisor of the lamp department.

The Eisler Engineering Company, Newark, N. J. has announced the appointment of Howard E. Kingdon as chief engineer and manager of the Transformer Department. He was formerly with the Commonwealth Electric Corporation Limited, Welland, Ontario as works manager of the Transformer Division.

Bentley, Harris Manufacturing Company, Conshohocken, Pa. has named the Western Fiberglas Supply, Ltd., 739 Bryant Street, San Francisco, 7, Calif. as West Coast representative.



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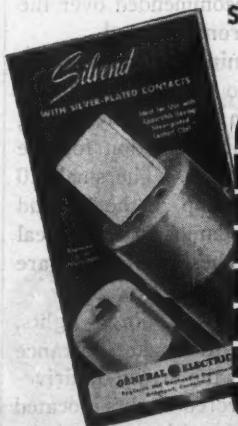
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Residence Lighting Techniques

[FROM PAGE 75]

Fig. (6a), should be used in the shower stall, especially when partially or wholly partitioned from the bath room. For medium and large bath rooms, an overhead ceiling unit should be installed. This ceiling unit may be either fluorescent or incandescent type.

Kitchen—The kitchen is primarily a work shop. As such, adequate lighting should be provided throughout. Intensities of 20 to 30 footcandles are now common, and much higher intensities are desirable for the work areas. Better light will aid in food preparation, sanitation, dishwashing and other kitchen chores.

Fluorescent lighting is well suited to kitchen illumination. The typical two 20 watt lamp units which have been sold in large quantities as "kitchen units" are not satisfactory for lighting kitchens. They do not produce adequate light. The majority of these units which have flooded the market are of the bare lamp type, which is also undesirable: Figs. 5a and 5b illustrate shielded type units using 40 and 100 watt lamps, suitable for ceiling mounting in the kitchen.

Play Room—Recessed ceiling units, either fluorescent or incandescent, are suitable in the play room. These units should be spaced fairly close together in order to provide uniform lighting at bridge table height.

Basement—Laundry and ironing facilities are usually located in basement rooms. Workshops also are often located here. Typical two lamp 40 watt industrial reflector type units mounted over the work areas provide good illumination for these tasks. Daylight lamps are recommended over the laundry tub and ironing board.

Entrance—Illuminated house numbers are helpful to guests, messengers and deliverymen in locating an address, and are a mark of distinction for the home owner or tenant. The small 10 watt incandescent lamp, or the 4, 6 and 8 watt fluorescent lamps provide ideal light sources for these units, and are inexpensive to operate.

Entrance brackets or porch lights, should be used to make entrance to the house from the street or driveway safe. Louvered lights located flush in the wall on either side of the entrance door about one foot above the entrance platform, also located in steps, may be used in lieu of brackets or ceiling porch lights.

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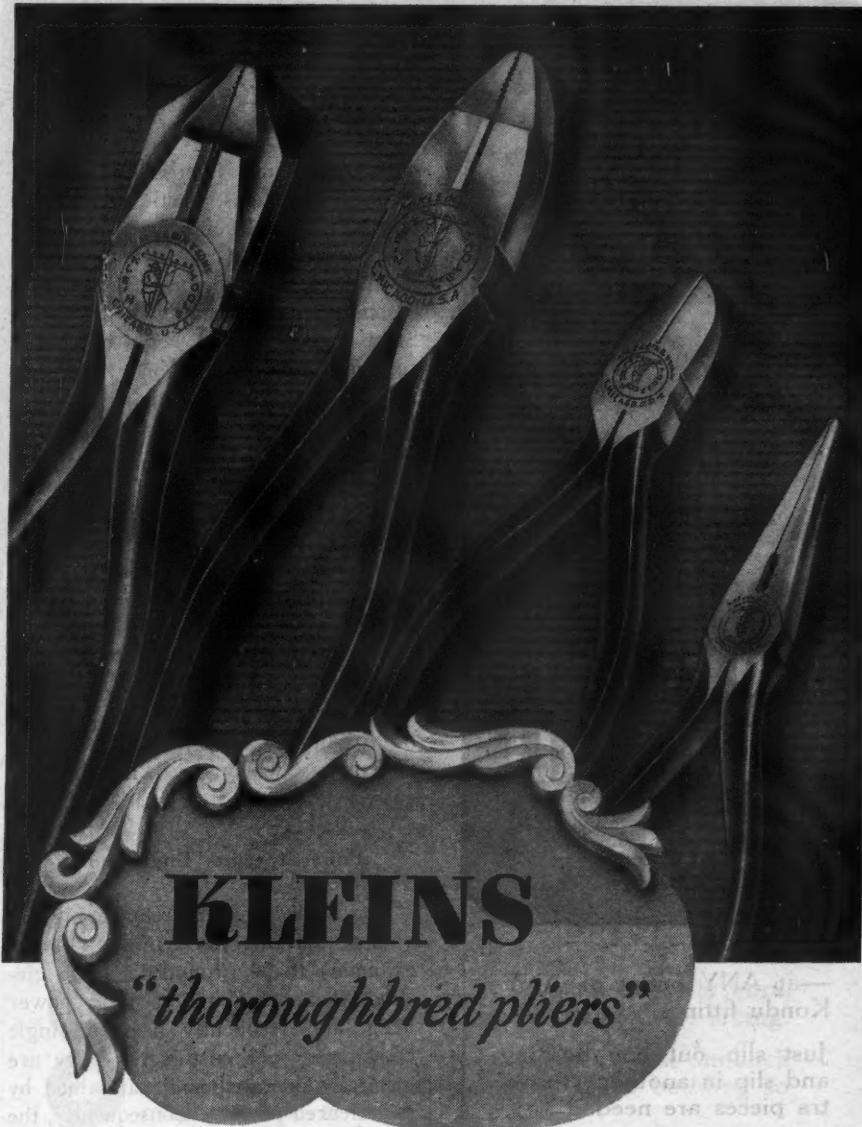
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Protective Grounding

[FROM PAGE 65]

it is practically impossible to keep secondary systems, particularly those serving several customers from a single transformer (as would usually be the case in residential areas), from becoming accidentally grounded. Since such a ground would not affect service (unless a second fault developed), it would ordinarily remain indefinitely. Furthermore, assuming an ungrounded 120-240 volt system, the accidental ground may occur on one of the outer conductors so that a person touching the other outer conductor would be subjected to 240 volts. It is evident, therefore, that grounding the circuit does not increase the low-voltage hazard, and for common types of fault actually decreases it. Grounding of the circuit also reduces the fire hazard and has some definite operating advantages which need not be discussed here.

Power Circuits Ungrounded

The Code does not require higher-voltage secondary circuits (440 for example) to be grounded. Such circuits, in general, are used for power loads and frequently have a single transformer per customer. They are generally operated and maintained by experienced people. Consequently, the probability of the circuit becoming accidentally grounded and remaining so is more remote. It should be pointed out that while the Code does not require such a circuit to be grounded, it in no way prohibits the grounding if the user so desires.

Low Resistance Electrodes

As indicated previously, except in water pipe areas it is, in general, not practicable to secure a grounding electrode which has a resistance of less than 10 ohms. In view of this, satisfactory low-voltage protection cannot ordinarily be obtained where separate grounding electrodes are used for circuits and equipment. This is illustrated in Figures 5 to 8 inclusive, which illustrate the effect of various methods of grounding. The conduit shown may be considered as any metallic enclosure for conductors or equipment.

In Figure 5, the circuit is grounded but the conduit is left ungrounded. Under this condition with a fault as shown the full secondary voltage can

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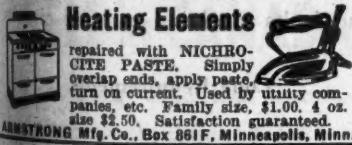


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remain on the conduit indefinitely regardless of the resistance of the grounding electrode connected to the circuit. This clearly is an unsatisfactory situation.

In Figure 6, the circuit and conduit are grounded to separate grounding electrodes. It will be noted that the resistances of the grounding electrodes are low compared to those usually obtained with driven grounding electrodes. Since the fault current is only 4 amperes, the fuse will not operate and the conduit will remain energized at 80 volts. In order to make the 1.5-ampere fuse operate, the sum of the resistances of R_1 and R_2 would need to be less than 8 ohms. This method of grounding is obviously unsatisfactory for low-voltage protection. Additional secondary grounds at the transformer or elsewhere on the secondary system would not help the situation, since the current would remain under 6 amperes.

Common Grounding Electrodes

With a common grounding electrode for the conduit and circuit as shown in Figure 7, a fault to the conduit causes a short circuit and hence blows the fuse promptly. The voltage of the conduit to ground during the short interval before fuse blowing will be equal to the voltage drop on the conduit between the fault and the point of attachment to the grounded circuit conductor. This, in general, will be quite small. From the standpoint of low-voltage protection, the resistance of the grounding electrode is not important provided a common grounding electrode is used for the circuit and equipment. As pointed out previously, the use of a common grounding electrode for circuit and equipment is also desirable from the standpoint of lightning and faults involving primary circuits.

Code Requirements

In practice, the Code requires that secondary circuits shall have at least two connections to grounding electrodes, as shown in Figure 8. If the resistance of the electrode at the service (R_1) is large compared to the resistance of the electrode (R_2) at the transformer or elsewhere, the voltage of the conduit to ground in case of a fault may approach 60 volts; i.e., one-half of the secondary voltage. Ordinarily, it will be less. The short circuit produced by the fault will, of course, immediately blow the fuse.

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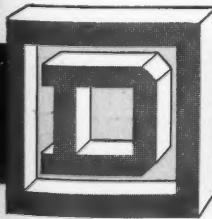
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- Tests without lamps. Positive voltage identification
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FOR FURTHER INFORMATION on Flamenol Building Wire or Cord or on G-E conduits or wiring devices, see the nearest G-E Merchandise Distributor or write to Section CDW851-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

FLAMENOL CORDS

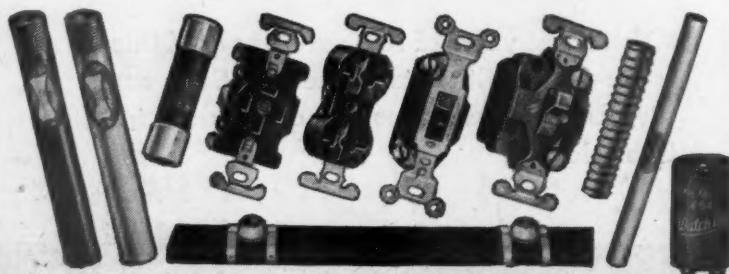
These rugged, flexible cords are available in three types: heavy duty for use under severe conditions, medium for use where conditions are less severe, a rip cord for use on lamps, small devices, etc. They are light in weight, easy to handle and have a pleasing appearance.

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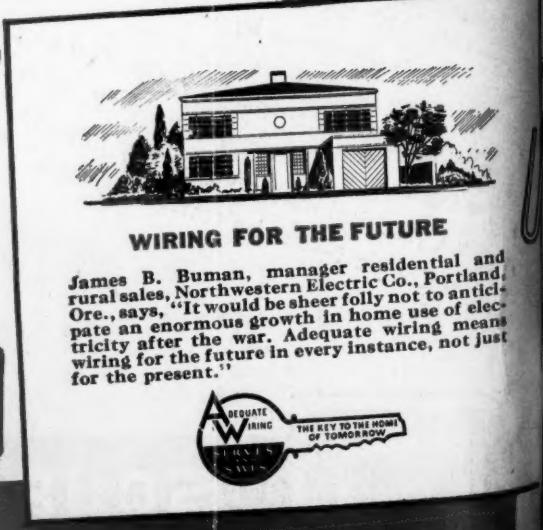
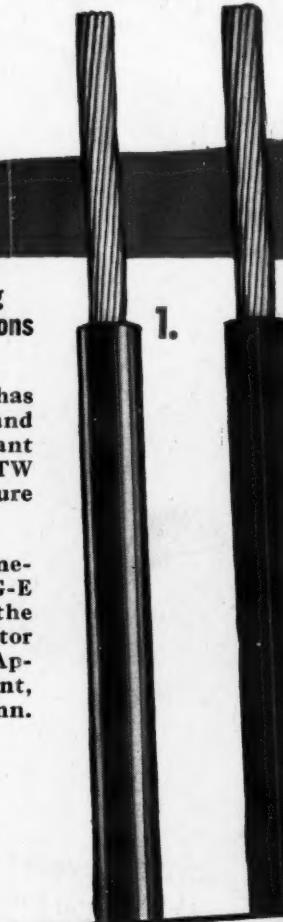
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WIRING FOR THE FUTURE

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